WEST SPRAY FIELD SAMPLING PLAN

1987

U. S. Department of Energy
Rocky Flats Plant
Golden, Colorado
February 27, 1987

Rockwell International
North American Space Operations
Rocky Flats Plant

TABLE OF CONTENTS

LIST OF TABLES

ATTACHMENTS

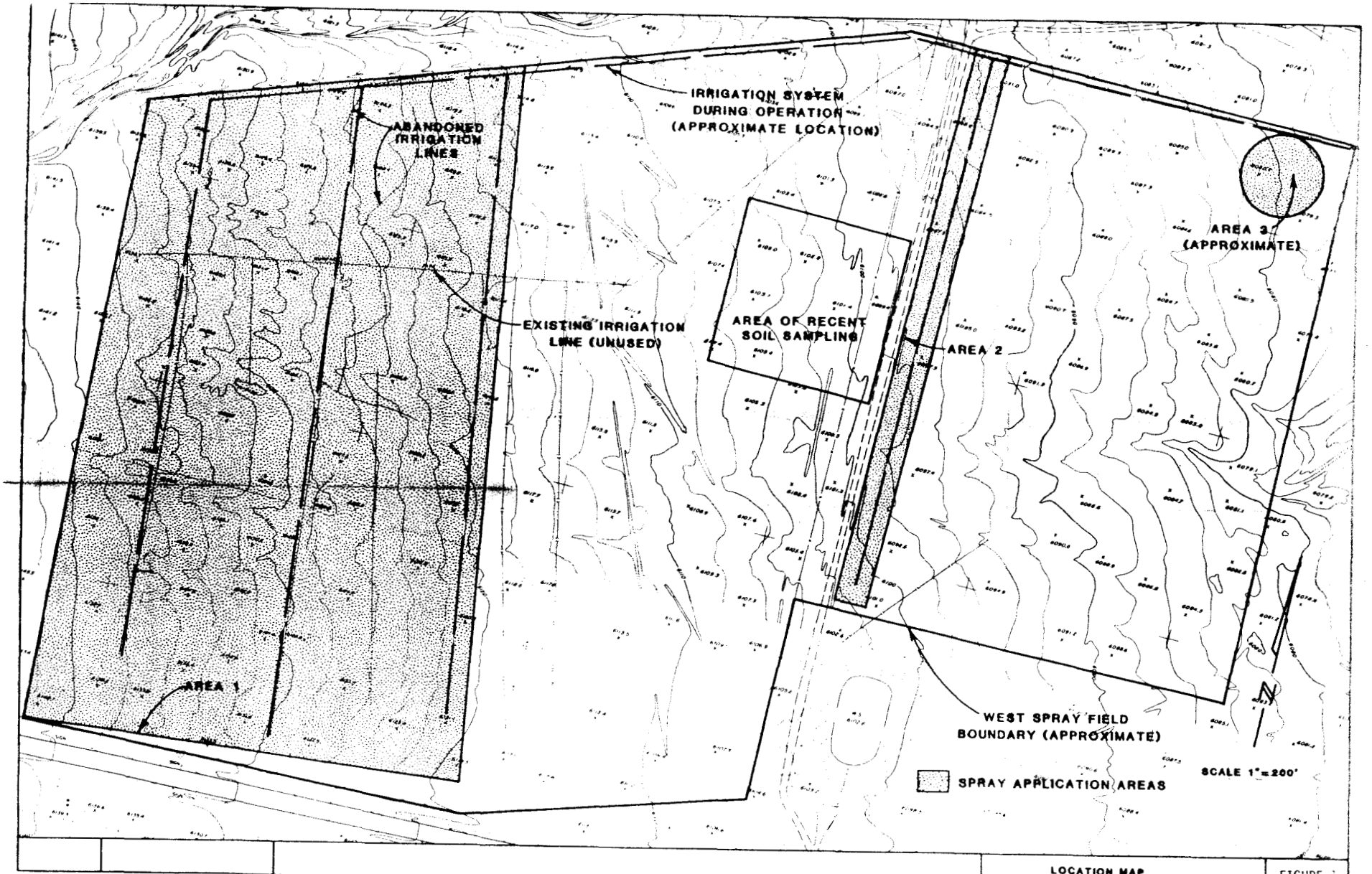
WEST SPRAY FIELD SAMPLING PLAN

1.0 INTRODUCTION

This sampling plan has been designed to provide an adequate data base for determining if soil treatment or removal operations are required at the West Spray Field for closure. The West Spray Field was used for spray application of excess liquids from the solar evaporation ponds 207-B North and Center during the period of April 1982 to October 1985. The majority of liquid in the ponds was derived from the interceptor trench pump house, with Pond 207-B Center also receiving some treated sanitary effluent from the Rocky Flats sanitary wastewater treatment plant. Direct application of the liquids occurred in the portion of the spray field designated Areas 1, 2, and 3 (Figure 1). 207B Solar Ponds liquid analyses were conducted during 1984 and 1985 (Table 1 and Attachment 1). For a more detailed description of the West Spray Field and past operations see Sections 1.0-1.5 of the West Spray Field Post-Closure Care Permit Application (Appendix A-3) of November 28, 1986, Post-Closure Care Permit Application (RI,1986a). Soil sampling work specific to the West Spray Field was not conducted until 1986.

2.0 FIELD WORK DATA EVALUATION

The 1986 field work was the result of a USEPA request for information regarding active and inactive waste management units. In order to gather the information for the West Spray Field requested by EPA, samples were



LOCATION MAP

FIGURE 1

TABLE 1

TWO SETS OF METAL ANALYSES OF
PONDS 207-B NORTH AND CENTER LIQUIDS
OCTOBER 1984 AND APRIL 1985

ELEMENT	POND 207-B NORTH mg/l	POND 207-B mg/l
Aluminum	0.16, 1	0.15, 2
Boron	0.29, 0.31	0.24, 0.67
Calcium	20.0, 290	2.9, 45.0
Cesium	ND[1]	ND, 0.041
Copper	ND	0.016, 0.037
Iron	0.28, 0.29	0.074, 0.2
Lead	ND, 0.0035	ND, 0.002
Lithium	0.37, 3.5	0.052, 0.41
Manganese	ND	0.022, 0.081
Magnesium	87.0, 120.0	3.9, 13.0
Molybdenum	ND, 0.0069	0.016, 0.037
Nickel	ND	0.015, 0.016
Phosphorous	ND	0.074, 0.2
Potassium	82.0, 120.0	30.0, 36.0
Selenium	0.01, 0.02	ND
Silicon	2.1, 5.6	2.4, 5.5
Silver	ND, 0.082	0.0016, 0.015
Sodium	37.0.0, 620.0	67.0, 250.0
Strontium	1.2, 3.5	0.28, 0.52

TABLE 1 (Continued)

SUMMARY OF TWO SETS OF METAL ANALYSES
PONDS 207-B NORTH AND CENTER LIQUIDS
TAKEN IN OCTOBER 1984 AND APRIL 1985

ELEMENT	POND 207-B NORTH (mg/l)	POND 207-B CENTER (mg/l)
Tritium	ND, 0.069	0.022, 0.041
Vanadium	ND	ND, 0.0081
Zinc	ND	ND, 0.041
Zirconium	ND	ND, 0.0041

1. ND indicates concentration below detection limit.

taken of liquid and sediment at both the Interceptor Trench Pump House (ITPH) and solar pond 207-B North, groundwater near the West Spray Field, and soil in the West Spray Field. These samples were collected in triplicate in April and May of 1986, but all the analytical data was not available for use until December of 1986. This field work and data will therefore be presented, evaluated, and discussed in this document.

The contents of the pond, interceptor trench, and soils at the West Spray Field were analyzed for the Hazardous Substance List (HSL) defined in CERCLA, plus plutonium 239, americium 241, tritium, uranium 233, 234, and 239, gross alpha, and gross beta in the 1986 sampling. Samples taken during this study were also analyzed for RCRA hazardous waste characteristics. See Appendix 1.2 of Section C of the RCRA Part B Permit Application for further details regarding the sampling (RI,1986b).

The raw data from the 1986 sampling is presented in Attachment 2 of this plan. The analytes found in the ITPH liquid, as well as the pond 207-B North liquids (207-B North contains no sediments), represent analytes that probably were applied to the West Spray Field soils.

2.1 APPLIED LIQUID DATA

The applied liquid characteristics are important because contaminants present in the West Spray Field would have originated in this applied water. The analytes found in the applied liquid can guide the selection of analytical parameters for soil sampling.

Tables I and II present data from liquid monitoring during 1984 and 1984. The raw data from these analyses can be found in Attachment 1. These data suggest that the applied liquid had fairly low concentrations of metals, with elevated levels of nitrates, alpha radiation and beta radiation. A more complete suite of analytical parameters were monitored in the 1986 sampling.

Very few analytes were identified above detection levels in any sample from the ITPH or pond 207-B in the 1986 sampling. Of the primary drinking water metals, only mercury was detected above the USEPA Certified Lab Protocol (CLP) detection limits. This detection occurred in all three samples of liquid from the ITPH. Both chromium and lead were detected above CLP detection limits in the pump house sediment. The lack of chromium and lead in the water indicates that these contaminants are most likely present in an insoluble form.

Various volatile organic contaminants were found in samples of the solar pond 207-B water and the ITPH samples, but the majority of the contaminants were also found in the sampling blank in comparable or higher concentrations. Therefore, these detections appear to represent laboratory contamination. Only the volatile organics carbon tetrachloride, chloroform, and trichloroethylene were detected above CLP detection limits in any liquid samples from the ITPH. Carbon tetrachloride was detected in three samples (6 PPB, 7 PPB, and 7 PPB), chloroform was detected in one sample (6 PPB), and trichloroethylene was detected in two samples (7 PPB and 8 PPB). The only volatile organic detected in Pond 207-B North water was methylene chloride. This compound

TABLE 2

SUMMARY OF WEEKLY PARAMETER MONITORING
PONDS 207-B NORTH AND CENTER LIQUIDS
1984 AND 1985

ANALYSIS	POND 207-B NORTH	POND 207-B CENTER
pH	range 7.5 - 9.6	range 7.3 - 11.3
Nitrates (as N) (ppm)	range 335 - 1367 average 629 (0/71)[3]	range ND[1] - 15.6 average (4.7)[2] (30/77)
Gross Alpha (pCi/l)	range ND - 323 average (144) (2/71)	range ND - 59 average (24) (45/77)
Gross Beta (pCi/l)	range ND - 163 average (63) (13/71)	range ND - 74 average (30) (60/77)

1. ND indicates less than detection limit or less than error limit.

2. Average presented is for reported concentrations greater than the detection limits.

3. Fraction represents number of non-detectable samples/total number of samples.

was detected at 28 PPB, 35 PPB, and 19 PPB in the water, but was also detected in the blank sample at the higher concentration of 71 PPB. Likewise, the volatile organic methylenechloride detected in the ITPH sediment (44 PPB and 27 PPB) was also found in the sampling blank (24 PPB). Acetone was above the CLP detection limits in both of the ITPH sediment samples (23 PPB and 47 PPB), and was not detected in the blank.

No pesticides or PCBs were detected in the ITPH water or sediment. Alpha-BHC (Alpha-Benzene Hexachloride, a pesticide, no other name) was detected in two samples (.06 PPB each sample), and heptachlor (.07 PPB) was detected in one sample of pond 207-B North liquid.

Semi-volatile analytes were not found in either the ITPH liquid or in the pond 207-B North liquid. The ITPH sediment samples were not analyzed due to shipping damage.

The results for plutonium, uranium, americium and gross alpha, as well as Derived Concentration Guides (DCGs) for these parameters are presented in Table 3. The levels of radionuclides in the liquids were below applicable Derived Concentration Guides for plutonium, americium, and uranium. The upper range of values for gross alpha (minus the activity of uranium) and gross beta were approximately twice the federal and state drinking water standards for these contaminants (Table 3).

Nitrates were not analyzed as part of the 1986 investigations, but nitrate in the liquid waste was monitored weekly during 1984 and 1985. A mass balance on nitrate and water gives an overall average nitrate concentration of 85-89 PPM in the applied water. These nitrate concentrations are approximately twice the drinking water standard of 45 ppm for nitrate.

2.2 SOIL ANALYTICAL DATA

Few analytical parameters were detected in the soil spray field samples; however, the soil samples were not taken in a high application area. The field soil samples were collected in an area that would only have been affected by wind spray and runoff. The low contaminant concentration in the liquid applied to the West Spray Field (the liquid typically met drinking water standards, except for nitrate), suggests that only low levels of contaminants could be present in the West Spray Field soil. It had been desired to sample high application area 3, but this area was improperly located in April of 1986 due to inaccurate information. The location of this area was conclusively determined in the fall of 1986.

Of the metallic parameters analyzed, only lead in the spray field surface samples (61 PPM, 63 PPM, and 42 PPM) appears elevated when compared to buffer zone soil (38 PPM, 48 PPM, and 42 PPM). At the 0-6 inch sampling depth and the 6-12 inch sampling depth all metallic parameters occur in comparable concentrations.

TABLE 3
RADIONUCLIDE DATA RANGE
1986 LIQUID SAMPLING

	ITPH Liquid Three Samples (pCi/l)	Pond 207B North Liquor Three Samples (pCi/l)	Derived Concentration Guide (pCi/l)[a]
Plutonium-239	0.05 - 0.16	-0.03 - 0.01	300
Americium-241	-0.01 - 0.02	-0.02 - 0.08	60
Uranium-233,234,238	103 - 110	81 - 86	500
Gross Alpha (excluding uranium)	-6 - 17	-12 - 39	15*
Gross Beta	75 - 120	-21 - 100	50**
Tritium	2700 - 3400	1200 - 1300	20,000**

* Federal and State Drinking Water Standard, excluding radon and uranium.

** Federal Drinking Water Standard.

[a] Calculated on the basis of DOE August 5, 1985, memorandum using DOE dose limit of 0.1 rem/yr to members of the public from all pathways, dose conversion factors given in the memorandum, and an intake rate of 2.0 liters per day of water. These values have been compared and are identical to those provided as draft Derived Concentration values in the DOE memorandum dated February 28, 1986.

The volatile organics methylene chloride (29-70 PPM), acetone (14-29 PPM), toluene (7-43 PPM), and chloroform (27 PPM) were detected in the West Spray Field Soil; but methylene chloride (28-46 PPM) and acetone (10-130 PPM) were also found in the buffer zone soil.

Semi-volatile and PCB compounds were not found in the spray field soil. Beta-BHC (Beta-Benzene Hexachloride, a pesticide, no other name.) was found in one surface scrape soil sample (9.7 PPB) of the spray field, as well as in one 6-12 inch composite sample (9.7 PPB). These two findings were found in different soil sampling locations. Neither soil sampling location had this analyte detected at any other sampling depth.

Radiochemistry results of the spray field soil were comparable to the results for the buffer zone soil (Table 4). None of the soil samples exhibited any of the RCRA hazardous waste characteristics. Nitrate in the soil samples was not analyzed.

2.3 GROUNDWATER ANALYTICAL DATA

Groundwater samples from wells 9-81 and 6-82 were collected during the spring 1986 West Spray Field sampling. The data are presented in Attachment 2. These data, for all parameters, indicate essentially unaffected groundwater quality. The majority of parameters detected in the groundwater samples were also detected in the blanks in comparable or higher concentrations. Only mercury in 2 samples (0.6 and 0.4 PPB) from

TABLE 4
RADIONUCLIDE DATA RANGE
1986 SOIL SAMPLING
(pCi/gm)

	Surface Scrape	
	Buffer Zone	Spray Field
Plutonium-239	0.02 - 0.10	0.04 - 0.12
Americium-241	-0.02 - 0.0	0.01 - 0.02
Uranium-233,234,238	1.99 - 2.6	2.1 - 2.3
Gross Alpha	67 - 75	40 - 55
Gross Beta	50 - 55	34 - 40

	0-6" composite	
	Buffer Zone	Spray Field
Plutonium-239	0.01 - 0.09	0.03 - 0.14
Americium-241	0.00 - 0.28	-0.02 - 0.05
Uranium-233,234,238	1.43 - 1.78	1.53 - 1.82
Gross Alpha	35 - 47	32 - 44
Gross Beta	30 - 40	29 - 34

	6-12" composite	
	Buffer Zone	Spray Field
Plutonium-239	0.03 - 0.05	-0.08 - 0.04
Americium-241	-0.02 - 0.07	-0.02
Uranium-233,234,238	1.29 - 1.51	1.20 - 1.65
Gross Alpha	18 - 37	20 - 31
Gross Beta	29 - 31	29

TABLE 5

Indicator Parameters

Gross Alpha

Plutonium 239

Uranium 233, 234, 238

Lead

Mercury

Carbon Tetrachloride

Chloroform

Trichloroethylene

Nitrate

plus TOC organic mobility assessments

well 6-82 were above detection limits and not also detected in a field blank. Further, sampling conducted during 1986 as part of the overall Rocky Flats groundwater assessment indicated that, with the possible exception of nitrate in alluvial groundwater downgradient of the west spray field, all other analyte concentrations including metals may simply be a reflection of natural groundwater variation (RI 1986b). These more recent data on groundwater are presented in Attachment 3.

3.0 INDICATOR PARAMETERS FOR ADDITIONAL SAMPLING WORK

Analyses of the liquid applied to the west spray field, the soils at the west spray field, and the groundwater quality near the west spray field are adequate to select indicator parameters for additional sampling. The indicator parameters are found in Table 5. These parameters were chosen based on presence in the applied liquid waste, the sediments associated with the applied liquid waste, the west spray field soil, or the groundwater monitoring wells near the west spray field. The analytes plutonium, uranium, and gross alpha were included due to the nature of the operations at the Rocky Flats Plant. Total organic carbon content of the spray field soil will also be assessed, but this will be used to predict the mobility of organic compounds in the soil and is not considered an indicator parameter.

4.0 SOURCE/CONTAMINANT CHARACTERIZATION

4.1 SOIL SAMPLING

Soils in the West Spray Field and the buffer zone will be sampled in June and July of 1987 to evaluate the extent of any soil contamination.

A total of twenty-five borings will be sampled in 1987. Twenty of these soil borings will be located in the West Spray Field. A three foot deep boring will be made at each location with either a bucket auger or with hand implements, depending upon soil conditions. Samples will be collected at the surface, and six inch composites thereafter to the bottom of each boring. All samples will be taken in duplicate by mixing the soil in an aluminum pan and filling separate sample containers with identical samples. One set of samples from a borehole will be used for total chemical analysis, the other set of samples may be used for leaching tests. Leaching tests will be conducted if contaminated soil is found with a 90% statistical certainty. All samples will be properly labeled, stored on ice, and transferred to permanent storage locations as soon as possible. The surface scrape, the 0-6 inch composite, and the 6-12 inch composite will be initially analyzed for total concentrations of indicator parameters. Five soil borings in the buffer zone soil will be made and analyzed in an identical manner to the above borings.

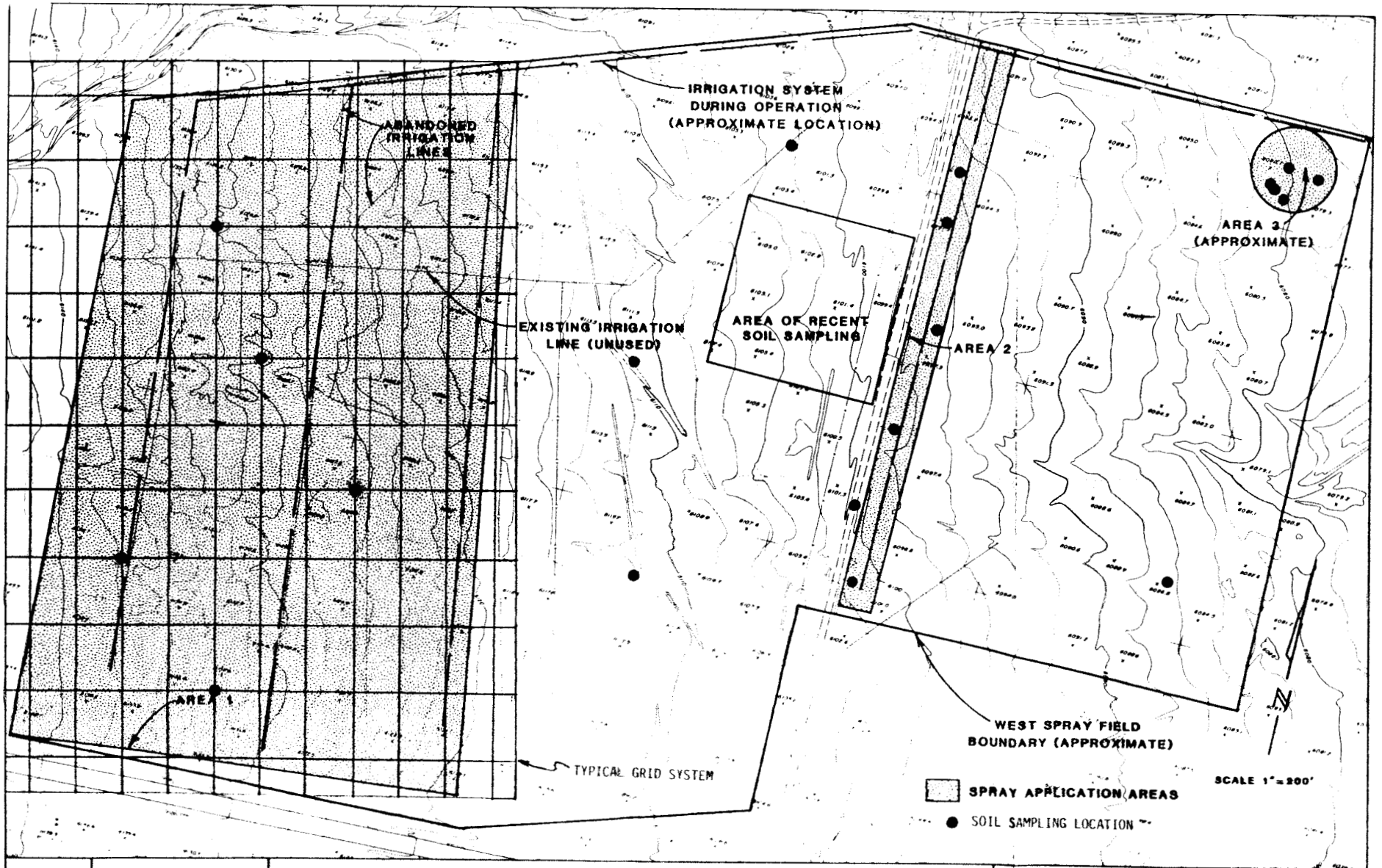
The boring distribution will consist of 5 borings each in high application area 1, high application area 2, high application area 3, low application areas, and 5 borings in the buffer zone soil as background samples. The number of borings is based upon the variance in parameters

found in the 1986 soil samples and knowledge of the location of high appliction and low application areas making up the spray field. This number of borings in each area will give a 90% confidence of defining contamination in the area, based upon a normal distribution of data, the 1986 soil analytical results for lead, and USEPA sampling procedures (USEPA 1983a). See Attachment 4 for the appropriate equations and calculations used in development. The number of borings and size of each area gave a matrix size that was then superimposed on a map of the area. The matrix nodes were numbered and sampling nodes randomly chosen with a random number generator (Figure 2).

After sampling any soil, the sampling equipment and aluminum trays will be thoroughly decontaminated. These items will be scrubbed with a tap water and detergent solution, rinsed with tap water, rinsed with acetone, rinsed with distilled water, and allowed to air dry. Mixing trowels will also be decontaminated after each grid has been sampled. Required sampling equipment is given in Table 6.

4.2 GROUNDWATER SAMPLING

There are currently 15 groundwater monitoring wells near the West Spray Field that will continue to be used for groundwater analysis. Of these wells, 7 are wells constructed previous to 1986, with the remainder constructed in 1986. Samples from these wells have not indicated contamination of the groundwater, except possibly with nitrate. Therefore, installation of additional monitoring wells near the West Spray Field is not required at this time. The data generated in the fall of 1986 and throughout 1987 from wells near the spray fields will be



SOIL SAMPLING LOCATION MAP

FIGURE 2

TABLE 6

SOIL SAMPLING EQUIPMENT

Analytical Request Form
Chain of Custody Forms
Logbook/ink pens
Watch
Sample Containers/labels
Hand auger
Split spoon sampler
Sledgehammer
Polyethylene sheeting
Paper towels
Shovel or trowels
Plastic or metal scoops
HPLC/distilled water
Hand spade
Aluminum pans for compositing
Neoprene gloves
Coolers with ice
Camera
Tape measure - 250'
Stakes
Survey tape

<u>Sample/Equipment Decontamination</u>

Wash bucket
Rinse bucket
Alkaline detergent
Brushes
Paper towels/plastic trash bags
Acetone
Tap water
Distilled water

evaluated as they become available. These wells will be sampled and analyzed quarterly for the next three quarters. In addition, areas of saturated soil encountered during soil sampling will be sampled and the filtered liquid analyzed for the indicator parameters of Table 5. Any such liquid samples will be filtered in the lab through a .45 micron filter.

4.3 DATA ANALYSIS/ADDITIONAL ANALYSES

An assessment of soil contamination will be based on statistically valid analyses of the 1987 sampling results, comparing concentrations of indicator parameters in background soil to concentrations in the west spray field soil. If no areas of soil contamination are defined at the 90% confidence level, no further soil analyses will be performed. The west spray field will be considered clean and closure certified. Groundwater monitoring wells near the Spray Field will continue to be sampled as part of the ongoing groundwater monitoring program. Wells and analytes may be added or deleted from the monitoring program near the West Spray Field pending results of the next three quarters of analyses.

If areas of soil contamination are identified at the 90% confidence level, further soil analyses may be required to define the extent of contamintion and future actions. If contamination appears to have migrated below the 6-12" composite sampling depth, then 12-18" and 18-24" composite samples of the appropriate sampling locations and buffer zone soils will be analyzed for the indicator parameters of Table 5. Composite samples at greater depth will be analyzed until either the 30-36" depth has been analyzed, or the maximum penetration of

contamination has been defined. If contamination extends below the 36" depth, borings to the groundwater table or bedrock, whichever is shallower, will be initiated for the gathering of additional core samples. Areas of contaminated soil will be further analyzed through the use of leaching tests as specified in Attachment 5 to this Plan. If the total attenuative capacity of underlying uncontaminated soil is greater than the total amount of an inorganic indicator parameter released by overlying contaminated soil, then groundwater degradation is not possible. If groundwater degradation is possible, then further studies will be conducted. These studies could include further groundwater monitoring wells, additional geologic work, risk assessment, or related work.

Contaminated soil treatment and removal options will be evaluated using guidance available in the land treatment literature. Calculations will be performed using organic degradation constants for various soils available in the literature for any organic contamination. Soil removal or treatment will be considered unnecessary for metals if the metal concentration in the soil is less than the maximum permissible level for soils remaining in place as presented in Hazardous Waste Land Treatment, USEPA, SW-874, April 1983 (USEPA, 1983b), and the metal concentrations do not pose a threat to groundwater quality. Soil treatment methods considered for contaminated soil will include tilling, bacterial enhancement, and in-situ soil leaching with groundwater recovery.

5.0 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Protocols for sample containers, sample preservation, and holding times will conform to those specified in Attachment 6.

6.0 SAMPLE CONTROL AND DOCUMENTATION

Procedures for sample control and documentation will conform to those specified in Attachment 6.

7.0 SAMPLE HANDLING, TRANSPORT, AND STORAGE

Procedures for sampling handling, transport, and storage will conform to those specified in Attachment 6.

8.0 SAMPLE PREPARATION AND ANALYSES

Procedures for sample preparation and analyses will conform to those specified in Attachment 6.

9.0 SCHEDULE

This schedule for closure is based upon currently available data and may require alteration based upon data to be gathered in 1987. Currently available data indicates that the West Spray Field soil is uncontaminated with any hazardous substances. It is anticipated that 1987 data will confirm this lack of contamination and that a clean closure will be certified. Should 1987 data not support this assumption, a revised closure plan will be submitted in December, 1987.

Activity	Date
Submission of Sampling Plan	February 28, 1987
Review and Regulatory Approval of Sampling Plan	June 1, 1987
Field Work	June-July, 1987
Receipt of Analytical Data	October 1, 1987
Data Analysis Report Complete	December 1, 1987
Certification of Clean Closure by an Independent, Registered Professional Engineer	January 1, 1988

REFERENCES

RI 1986A: "Resource Conservation and Recovery Act Part B - Post-Closure Care Permit Application for USDOE Rocky Flats Plant, Hazardous and Radioactive Mixed Wastes, "U.S. Department of Energy unnumbered report, November 1986.

RI 1986B: "Resource Conservation and Recovery Act Part B - USDOE Rocky FLats Plant, Hazardous and Radioactive Mixed Waste, "U.S. Department of Energy unnumbered report, November 1986.

USEPA 1983A: "Preparation of Soil Sampling Protocol: Technique and Strategies, "U.S. Environmental Protection Agency, EPA-600/4-83-020, August 1983.

USEPA 1983B: "Hazardous Waste Land Treatment," U.S. Environmental Protection Agency, EPA-SW-874, April 1983.

ATTACHMENT 1

SOLAR POND 207-B

MONITORING DATA

COD078343407

Date: November 8, 1985
Revision No.: 0

POND 207B DATA

ANALYTICAL REPORT

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T. Greengard, T452B HS&E
File

LAB NUMBER: M85-2220
DATE: 10-08-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 9-17-85

Analysis	North	Center
pH (S.U.)	9.3	9.3
NO^-_3 as N (mg/L)	727	1.4
Gross Alpha (pCi/L)	209 ± 21	7 ± 3
Gross Beta (pCi/L)	109 ± 63	59 ± 4

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LAB NUMBER: M85-2157
DATE: 9-30-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 9-10-85

Analysis	North	Center
pH (S.U.)	9.2	9.7
NO^-_3 as N (mg/L)	746	<1.0
Gross Alpha (pCi/L)	268 ± 89	24 ± 5
Gross Beta (pCi/L)	23 ± 16	-4 ± 25

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LAB NUMBER: M85-2096
DATE: 9-30-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 8-27-85

Analysis	North	Center
pH (S.U.)	9.0	10.3
NO^-_3 as N (mg/L)	716	<1.0
Gross Alpha (pCi/L)	323 ± 33	-4 ± 0
Gross Beta (pCi/L)	96 ± 25	-8 ± 11
Pu-239 (pCi/L)	71.2	*
U- Total (pCi/L)	82.6	*
Am-241 (pCi/L)	57.6	*

* Not requested

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LAB NUMBER: M85-2035
DATE: 9-30-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 8-20-85

Analysis	North	Center
pH (S.U.)	8.7	10.6
NO^-_3 as N (mg/L)	676	<1.0
Gross Alpha (pCi/L)	113 ± 38	19 ± 5
Gross Beta (pCi/L)	41 ± 10	6 ± 16

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File

LAB NUMBER: M85-1973
DATE: 9-30-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 8-13-85

Analysis	North	Center
pH (S.U.)	8.8	9.6
NO^-_3 as N (mg/L)	615	<1.0
Gross Alpha (pCi/L)	110 ± 6	0 ± 0
Gross Beta (pCi/L)	77 ± 5	9 ± 4

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File

LAB NUMBER: M85-1915
DATE: 9-30-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 8-6-85

Analysis	North	Center
pH (S.U.)	9.1	10.0
NO^-_3 as N (mg/L)	590	<1.0
Gross Alpha (pCi/L)	166 ± 31	6 ± 2
Gross Beta (pCi/L)	115 ± 7	29 ± 8

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File

LAB NUMBER: M85-1860
DATE: 8-9-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7-30-85

Analysis	North	Center
pH (S.U.)	9.1	9.9
NO^-_3 as N (mg/L)	627	2.0
Gross Alpha (pCi/L)	200 ± 86	38 ± 20
Gross Beta (pCi/L)	57 ± 12	34 ± 39

ANALYTICAL REPORT

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File

LAB NUMBER: M85-1787
DATE: 7-29-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7-23-85

Analysis	North	Center
pH (S.U.)	8.9	10.3
NO_3^- as N (mg/L)	625	<1.0
Gross Alpha (pCi/L)	169 ± 14	18 ± 11
Gross Beta (pCi/L)	52 ± 15	11 ± 0

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LAB NUMBER: M85-1733
DATE: 7-19-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 7-16-85

Analysis	North	Center
pH (S.U.)	8.8	10.0
NO_3^- as N (mg/L)	718	<1.0
Gross Alpha (pCi/L)	215 ± 14	22 ± 12
Gross Beta (pCi/L)	45 ± 24	22 ± 23

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LAB NUMBER: M85-1662
DATE: 7-19-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7-9-85

Analysis	North	Center
pH (S.U.)	8.4	10.4
NO^-_3 as N (mg/L)	662	<1.0
Gross Alpha (pCi/L)	112 ± 16	6 ± 9
Gross Beta (pCi/L)	52 ± 42	-3 ± 21

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LAB NUMBER: M85-1615
DATE: 7-23-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7-2-85

Analysis	North	Center
pH (S.U.)	8.7	11.0
NO_3^- as N (mg/L)	634	<1.0
Gross Alpha (pCi/L)	118 ± 10	19 ± 10
Gross Beta (pCi/L)	88 ± 20	26 ± 36

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LAB NUMBER: M85-1555
DATE: 7-11-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B
(Weekly Sample)

1) North 1) Center
Received: 6-25-85

Analysis	North	Center
pH (S.U.)	8.6	10.7
NO_3^- as N (mg/L)	815	<1.0
Gross Alpha (pCi/L)	70 ± 0	7 ± 9
Gross Beta (pCi/L)	95 ± 13	5 ± 0

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File

LAB NUMBER: M85-1499
DATE: 6-26-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 6-18-85

Analysis	North	Center
pH (S.U.)	9.1	10.2
NO_3^- as N (mg/L)	658	<1.0
Gross Alpha (pCi/L)	231 ± 19	18 ± 0
Gross Beta (pCi/L)	44 ± 17	33 ± 15

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LAB NUMBER: M85-1433
DATE: 6-20-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 6-11-85

Analysis	North	Center
pH (S.U.)	7.5	9.2
NO_3^- as N (mg/L)	732	<1.0
Gross Alpha (pCi/L)	175 ± 16	27 ± 7
Gross Beta (pCi/L)	39 ± 0	45 ± 55

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LAB NUMBER: M85-1360
DATE: 6-20-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 6-4-85

Analysis	North	Center
pH (S.U.)	9.1	9.4
NO_3^- as N (mg/L)	616	<1.0
Gross Alpha (pCi/L)	88 ± 27	8 ± 9
Gross Beta (pCi/L)	50 ± 24	49 ± 9

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File

LAB NUMBER: M85-1292
DATE: 6-7-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 5-28-85

Analysis	North	Center
pH (S.U.)	9.3	10.6
NO^-_3 as N (mg/L)	660	<1.0
Gross Alpha (pCi/L)	29 ± 14	19 ± 18
Gross Beta (pCi/L)	118 ± 34	20 ± 44

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LAB NUMBER: M85-1233
DATE: 6-7-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 5-21-85

Analysis	North	Center
pH (S.U.)	9.4	10.9
NO^-_3 as N (mg/L)	632	<1.0
Gross Alpha (pCi/L)	165 ± 9	32 ± 14
Gross Beta (pCi/l)	80 ± 0	12 ± 8

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File

LAB NUMBER: M85-1160
DATE: 5-22-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 5-14-85

Analysis	North	Center
pH (S.U.)	8.6	11.0
NO^-_3 as N (mg/L)	662	<1.0
Gross Alpha (pCi/L)	161 ± 15	41 ± 2
Gross Beta (pCi/L)	43 ± 24	-9 ± 4

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File

LAB NUMBER: M85-1082
DATE: 5-17-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 5-7-85

Analysis	North	Center
pH (S.U.)	9.2	11.0
NO_3^- as N (mg/L)	557	<1.0
Gross Alpha (pCi/L)	195 ± 19	7 ± 14
Gross Beta (pCi/L)	37 ± 7	9 ± 3

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LAB NUMBER: M85-1003
DATE: 5-16-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 4-30-85

Analysis	North	Center
pH (S.U.)	9.0	10.7
NO^-_3 as N (mg/L)	656	1.8
Gross Alpha (pCi/L)	129 ± 10	29 ± 22
Gross Beta (pCi/L)	30 ± 28	-5 ± 3

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File

LAB NUMBER: M85-0947
DATE: 5-3-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B
(Weekly Sample)

1) North 1) Center
Received: 4-23-85

Analysis	North	Center
pH (S.U.)	9.2	10.8
NO_3 as N (mg/L)	651	2.4
Gross Alpha (pCi/L)	149 ± 23	27 ± 4
Gross Beta (pCi/L)	47 ± 33	31 ± 0

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File

LAB NUMBER: M85-0892
DATE: 4-25-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 4-16-85

Analysis	North	Center
pH (S.U.)	9.3	10.1
NO_3 as N (mg/L)	615	3.2
Gross Alpha (pCi/L)	154 ± 4	14 ± 2
Gross Beta (pCi/L)	20 ± 6	7 ± 14

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File

LAB NUMBER: M85-0824
DATE: 4-19-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 4-9-85

Analysis	North	Center
pH (S.U.)	9.2	8.9
NO_3 as N (mg/L)	630	4.3
Gross Alpha (pCi/L)	108 ± 3	14 ± 4
Gross Beta (pCi/L)	64 ± 13	10 ± 10

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File

LAB NUMBER: M85-0766
DATE: 4-15-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North
1) Center
Received: 4-2-85

Analysis	North	Center
pH (S.U.)	9.1	8.5
NO_3 as N (mg/L)	540	5.3
Gross Alpha (pCi/L)	33 ± 0	18 ± 2
Gross Beta (pCi/L)	86 ± 0	20 ± 28

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File

LAB NUMBER: M85-0712
DATE: 4-15-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 3-26-85

Analysis	North	Center
pH (S.U.)	9.2	10.1
NO_3 as N (mg/L)	492	5.1
Gross Alpha (pCi/L)	186 ± 105	26 ± 7
Gross Beta (pCi/L)	156 ± 54	17 ± 2

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File

LAB NUMBER: M85-0642
DATE: 3-28-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)
1) North 1) Center
Received: 3-14-85

Analysis	North	Center
pH (S.U.)	9.0	10.8
NO_3 as N (mg/L)	585	2.9
Gross Alpha (pCi/L)	230 ± 56	16 ± 3
Gross Beta (pCi/L)	163 ± 25	25 ± 22

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File

LAB NUMBER: M85-0573
DATE: 3-26-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 3-12-85

Analysis	North	Center
pH (S.U.)	8.8	10.7
NO_3 as N (mg/L)	390	2.2
Gross Alpha (pCi/L)	$(1.3 \pm 0.4) \times 10^2$	19 ± 13
Gross Beta (pCi/L)	$(1.6 \pm 0.1) \times 10^2$	31 ± 16

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LAB NUMBER: M85-0501
DATE: 3-26-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 3-5-85

Analysis	North	Center
pH (S.U.)	*	10.1
NO_3 as N (mg/L)	*	15.6
Gross Alpha (pCi/L)	*	59 ± 23
Gross Beta (pCi/L)	*	73 ± 0

* No sample received - Pond Frozen

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LAB NUMBER: M85-0433
DATE: 3-26-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 2-26-85

Analysis	North	Center
pH (S.U.)	*	10.4
NO_3 as N (mg/L)	*	3.4
Gross Alpha (pCi/L)	*	-2 ± 10
Gross Beta (pCi/L)	*	38 ± 19

* No sample received - Pond Frozen.

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LAB NUMBER: M84-3027
DATE: 12-24-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 12-11-84

Analysis	North	Center
pH (S.U.)	*	9.2
NO_3 as N (mg/L)	FROZEN	4.1
Gross Alpha (pCi/L)	NO	4 ± 11
Gross Beta (pCi/L)	SAMPLE	3 ± 21

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File

LAB NUMBER: M84-2952
DATE: 12-12-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 12-4-84

Analysis	North	Center
pH (S.U.)	*	10.0
NO_3 as N (mg/L)	•	4.0
Gross Alpha (pCi/L)	•	6 ± 17
Gross Beta (pCi/L)	•	3 ± 26

* Pond frozen

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LAB NUMBER: M84-2888
DATE: 12-12-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 11-27-84

Analysis	North	Center
pH (S.U.)	8.1	10.7
NO_3 as N (mg/L)	579	2.9
Gross Alpha (pCi/L)	160 ± 63	1 ± 11
Gross Beta (pCi/L)	29 ± 29	5 ± 24

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File

LAB NUMBER: M84-2855
DATE: 12-12-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 11-20-84

Analysis	North	Center
pH (S.U.)	8.0	10.6
NO_3 as N (mg/L)	579	5.5
Gross Alpha (pCi/L)	217 ± 80	34 ± 19
Gross Beta (pCi/L)	11 ± 24	17 ± 26

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LAB NUMBER: M84-2787
DATE: 11-29-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 11-13-84

Analysis	North	Center
pH (S.U.)	8.3	10.8
NO_3 as N (mg/L)	500	<1.0
Gross Alpha (pCi/L)	203 ± 94	20 ± 14
Gross Beta (pCi/L)	46 ± 43	-2 ± 28

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File

LAB NUMBER: M84-2724
DATE: 11-29-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B
(Weekly Sample)

1) North 1) Center
Received: 11-6-84

Analysis	North	Center
pH (S.U.)	8.3	10.7
NO_3 as N (mg/L)	570	2.7
Gross Alpha (pCi/L)	143 ± 55	11 ± 16
Gross Beta (pCi/L)	19 ± 37	-5 ± 23

ANALYTICAL REPORT

ROCKWELL INTERNATIONAL
ENERGY SYSTEMS GROUP
P.O. BOX 464
GOLDEN, COLORADO 80401

GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry, T452B HS&E
C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2664
DATE: 11-7-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 10-30-84

Analysis	North	Center
pH (S.U.)	8.2	10.5
NO_3 as N (mg/L)	535	2.2
Gross Alpha (pCi/L)	165 ± 62	5 ± 10
Gross Beta (pCi/L)	53 ± 44	-5 ± 22

ANALYTICAL REPORT

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BUILDING 881

DISTRIBUTION:

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C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
✓T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2604
DATE: 11-7-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 10-23-84

Analysis	North	Center
pH (S.U.)	8.2	10.6
NO_3 as N (mg/L)	530	<1.0
Gross Alpha (pCi/L)	116 ± 42	11 ± 12
Gross Beta (pCi/L)	48 ± 47	3 ± 26

ANALYTICAL REPORT

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DISTRIBUTION:

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C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2541
DATE: 10/22/84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B
(Weekly Sample)

1) North 1) Center
Received: 10/17/84

Analysis	North	Center
pH (S.U.)	7.8	10.5
NO_3 as N (mg/L)	600	1.6
Gross Alpha (pCi/L)	123 ± 50	2 ± 11
Gross Beta (pCi/L)	39 ± 35	3 ± 23

ANALYTICAL REPORT

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DISTRIBUTION:

R. L. Henry, T452B HS&E
C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2479
DATE: 10/22/84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 10/9/84

Analysis	North	Center
pH (S.U.)	8.3	10.9
NO_3 as N (mg/L)	570	< 1.0
Gross Alpha (pCi/L)	124 ± 54	8 ± 9
Gross Beta (pCi/L)	39 ± 39	-3 ± 24

ANALYTICAL REPORT

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DISTRIBUTION:

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C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
✓T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2425
DATE: 10/22/84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)
1) North 1) Center
Received: 10/2/84

Analysis	North	Center
pH (S.U.)	8.3	10.9
NO_3 as N (mg/L)	720	< 1.0
Gross Alpha (pCi/L)	97 ± 38	4 ± 15
Gross Beta (pCi/L)	44 ± 38	2 ± 26

ANALYTICAL REPORT

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DISTRIBUTION:

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C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2377
DATE: 10-05-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 9-25-84

Analysis	North	Center
pH (S.U.)	8.4	11.1
NO_3 as N (mg/L)	335	<1.0
Gross Alpha (pCi/L)	98 ± 45	8 ± 14
Gross Beta (pCi/L)	38 ± 45	8 ± 29

ANALYTICAL REPORT

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GENERAL LABORATORY
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DISTRIBUTION:

R. L. Henry, T452B HS&E
C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2312
DATE: 10-05-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B
(Weekly Sample)

1) North 1) Center
Received: 9-18-84

Analysis	North	Center
pH (S.U.)	8.4	11.1
NO_3 as N (mg/L)	560	2.6
Gross Alpha (pCi/L)	126 ± 56	15 ± 16
Gross Beta (pCi/L)	39 ± 50	-8 ± 27

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry, T452B HS&E
C. T. Illsley, T452B HS&E
R. D. Gaskins, 374 Liq Wste Ops
T. Greengard, T452B HS&E
File

LAB NUMBER: M84-2247
DATE: 9-27-84
ACCOUNT NO: 331

APPROVED: D. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 9-11-84

Analysis	North	Center
pH (S.U.)	8.7	11.1
NO_3 as N (mg/L)	852	<1.0
Gross Alpha (pCi/L)	157 ± 63	3 ± 13
Gross Beta (pCi/L)	30 ± 44	17 ± 30

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
T. Greengard T452B
File

LAB NUMBER: M84-2173
DATE: 9-13-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 9/4/84

Analysis	North	Center
pH (S.U.)	8.9	10.7
NO_3 as N (mg/L)	340	<1.0
Gross Alpha (pCi/L)	15 ± 79	30 ± 22
Gross Beta (pCi/L)	60 ± 45	13 ± 26

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
T. Greengard T452B
File

LAB NUMBER: M84-2124
DATE: 9-13-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 8/28/84

Analysis	North	Center
pH (S.U.)	9.0	10.6
NO_3 as N (mg/L)	590	<1.0
Gross Alpha (pCi/L)	13 ± 50	4 ± 8
Gross Beta (pCi/L)	24 ± 43	8 ± 31

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
T. Greengard T452B
File

LAB NUMBER: M84-2043
DATE: 8/28/84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 8/21/84

Analysis	North	Center
pH (S.U.)	9.0	10.2
NO_3 as N (mg/L)	682	1.2
Gross Alpha (pCi/L)	87 ± 42	24 ± 20
Gross Beta (pCi/L)	61 ± 52	24 ± 33

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1992
DATE: 8/20/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 8/14/84

Analysis	North	Center
pH (S.U.)	9.3	10.2
NO_3 as N (mg/L)	676	< 1.0
Gross Alpha (pCi/L)	141 ± 66	18 ± 25
Gross Beta (pCi/L)	16 ± 32	-2 ± 26

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1938
DATE: 8/20/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 8/7/84

Analysis	North	Center
pH (S.U.)	8.4	7.4
NO_3 as N (mg/L)	647	< 1.0
Gross Alpha (pCi/L)	95 ± 46	1 ± 16
Gross Beta (pCi/L)	15 ± 38	20 ± 29

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
✓N. D. Hoffman T452B
File

LAB NUMBER: M84-1884
DATE: 8/15/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 7/31/84

Analysis	North	Center
pH (S.U.)	8.9	11.0
NO_3 as N (mg/L)	765	1.2
Gross Alpha (pCi/L)	117 ± 74	30 ± 24
Gross Beta (pCi/L)	27 ± 43	0 ± 29

ANALYTICAL REPORT

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BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1815
DATE: 7/30/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7/24/84

Analysis	North	Center
pH (S.U.)	9.0	10.9
NO_3 as N (mg/L)	743	<1.0
Gross Alpha (pCi/L)	80 ± 32	15 ± 19
Gross Beta (pCi/L)	20 ± 40	17 ± 30

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
✓N. D. Hoffman T452B
File

LAB NUMBER: M84-1751
DATE: 7/24/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 7/17/84

Analysis	North	Center
pH (S.U.)	8.5	10.4
NO_3 as N (mg/L)	575	< 1.0
Gross Alpha (pCi/L)	143 ± 58	7 ± 19
Gross Beta (pCi/L)	61 ± 66	25 ± 32

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1690
DATE: 7/24/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7/10/84

Analysis	North	Center
pH (S.U.)	9.3	11.2
NO_3 as N (mg/L)	690	< 1.0
Gross Alpha (pCi/L)	90 ± 38	12 ± 18
Gross Beta (pCi/L)	52 ± 46	37 ± 39

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1650
DATE: 7/24/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 7/3/84

Analysis	North	Center
pH (S.U.)	9.2	10.9
NO_3 as N (mg/L)	633	3.7
Gross Alpha (pCi/L)	153 ± 70	6 ± 23
Gross Beta (pCi/L)	62 ± 55	20 ± 35

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1593
DATE: 7/6/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)
1) North 1) Center
Received: 6/26/84

Analysis	North	Center
pH (S.U.)	9.6	8.9
NO_3 as N (mg/L)	675	1.9
Gross Alpha (pCi/L)	124 ± 67	43 ± 25
Gross Beta (pCi/L)	67 ± 49	-6 ± 27

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

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C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1523
DATE: 7/6/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)
1) North 1) Center
Received: 6/19/84

Analysis	North	Center
pH (S.U.)	9.3	8.2
NO_3 as N (mg/L)	674	1.9
Gross Alpha (pCi/L)	250 ± 132	7 ± 20
Gross Beta (pCi/L)	55 ± 51	11 ± 33

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

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C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1467
DATE: 7/24/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 6/12/84

Analysis	North	Center
pH (S.U.)	8.9	7.7
NO_3 as N (mg/L)	667	1.0
Gross Alpha (pCi/L)	84 ± 49	10 ± 16
Gross Beta (pCi/L)	35 ± 39	23 ± 30

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

C. T. Illsley T-452B
N. D. Hoffman T-452B
R. L. Henry T-452B
R. D. Gaskins 374
File

LAB NUMBER: M84-1417
DATE: 8/15/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

207B Solar Pond - Quarterly Sample Received: 6/5/84

Analysis	Result
pH (S.U.)	9.6
NO_3 as N (mg/L)	2650
Total Dissolved Solids (mg/L)	2109
Gross Alpha (pCi/L)	2886 $\pm$ 2423
Gross Beta (pCi/L)	722 $\pm$ 250
Pu - 239 (pCi/L)	(3.0 $\pm$ 1.9) X 10^1
Am - 241 (pCi/L)	(9.7 $\pm$ 3.4) X 10^1
U (pCi/L)	(3.3 $\pm$ 0.2) X 10^3
^3H (pCi/L)	(6.4 $\pm$ 0.6) X 10^3

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

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C. T. Illsley T452B
R. D. Gaskins 374
√N. D. Hoffman T452B
File

LAB NUMBER: M84-1410
DATE: 6/14/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 6/5/84

Analysis	North	Center
pH (S.U.)	8.6	8.2
NO_3 as N (mg/L)	600	3.1
Gross Alpha (pCi/L)	142 ± 63	8 ± 15
Gross Beta (pCi/L)	58 ± 46	29 ± 31

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1347
DATE: 6/14/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 5/29/84

Analysis	North	Center
pH (S.U.)	8.7	9.6
NO_3 as N (mg/L)	600	1.7
Gross Alpha (pCi/L)	145 ± 64	20 ± 19
Gross Beta (pCi/L)	37 ± 37	8 ± 25

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1298
DATE: 6/7/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 5/22/84

Analysis	North	Center
pH (S.U.)	8.7	10.8
NO_3 as N (mg/L)	628	5.8
Gross Alpha (pCi/L)	134 ± 59	6 ± 14
Gross Beta (pCi/L)	47 ± 56	17 ± 33

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1221
DATE: 6/7/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)
1) North 1) Center
Received: 5/15/84

Analysis	North	Center
pH (S.U.)	8.5	10.9
NO_3 as N (mg/L)	605	6.1
Gross Alpha (pCi/L)	132 ± 59	12 ± 13
Gross Beta (pCi/L)	51 ± 41	-11 ± 26

ANALYTICAL REPORT

ROCKWELL INTERNATIONAL
ENERGY SYSTEMS GROUP
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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
✓File

LAB NUMBER: M84-1158
DATE: 6/7/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 5/8/84

Analysis	North	Center
pH (S.U.)	8.2	10.3
NO_3 as N (mg/L)	628	3.2
Gross Alpha (pCi/L)	121 ± 53	18 ± 19
Gross Beta (pCi/L)	51 ± 31	5 ± 25

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ANALYTICAL REPORT

GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

LAB NUMBER: M84-1091
DATE: 5/18/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample) 1) North 1) Center
Received: 5/1/84

Analysis	North	Center
pH (S.U.)	8.5	11.2
NO_3 as N (mg/L)	561	4.8
Gross Alpha (pCi/L)	105 $\pm$ 48	-3 $\pm$ 12
Gross Beta (pCi/L)	43 $\pm$ 32	0 $\pm$ 24

ANALYTICAL REPORT

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GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. L. Henry T452B
R. T. Illsley T452B
R. D. Gaskins 374
R. D. Hoffman T452B
File

LAB NUMBER: M84-1012
DATE: 5/9/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 4/24/84

Analysis	North	Center
pH (S.U.)	8.3	11.0
NO_3 as N (mg/L)	645	4.8
Gross Alpha (pCi/L)	162 ± 70	18 ± 14
Gross Beta (pCi/L)	49 ± 33	23 ± 26

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:. L. Henry T452B
:. T. Illsley T452B
:. D. Gaskins 374
. D. Hoffman T452B
:le

LAB NUMBER: M84-963
DATE: 5/9/84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

AMPLE DESCRIPTION

Solar Evaporation Pond 207B (Weekly Sample)

1) North 1) Center
Received: 4/17/84

alysis	North	Center
H (S.U.)	8.4	11.1
NO_3 as N (mg/L)	563	5.5
ross Alpha (pCi/L)	98 ± 48	6 ± 17
ross Beta (pCi/L)	71 ± 41	21 ± 25

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C. T. Illsley T452B
R. D. Gaskins 374
File

LAB NUMBER: M84-902
DATE: 4-16-84
ACCOUNT NO: 331

APPROVED: J. A. Palcic

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B
Samples: 1) North 2) Center
Received: 4-10-84

ANALYSIS RESULTS

Analysis	North	Center
Gross Alpha (pCi/L)	209 ± 91	2 ± 16
Gross Beta (pCi/L)	53 ± 42	12 ± 27
pH (S.U.)	8.5	11.1
NO_3 as N (mg/L)	537	3.9

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ANALYTICAL REPORT

Account No. 331 Date 4-10-84 Lab. No. M84-825

Henry T452B
Illsley T452B
Gaskins 374
Hoffman T452B

Reported by

Approved J. A. Palcic

Description

Solar Evaporation Pond 207B - 1) North 2) Center

Received: 4-3-84

Results

Analysis	North	Center
Ph (S.U.)	8.2	10.2
NO_3 as N (mg/L)	531	4.7
Gross Alpha (pCi/L)	283 ± 133	18 ± 21
Gross Beta (pCi/L)	72 ± 47	21 ± 29

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ANALYTICAL REPORT

Account No. 331 Date 4-3-84 Lab. No. M84-766

L. Henry T452B
T. Illsley T452B
D. Gaskins 374
D. Hoffman T452B
Te

Reported by

Approved J. A. Palcic

Description

Solar Evaporation Pond 207B - Samples North & Center

Received: 3-27-84

Results

Analysis	North	Center
Gross Beta (pCi/L)	53 ± 40	3 ± 23
Gross Alpha (pCi/L)	139 ± 63	12 ± 15
pH	8.1	10.5
NO_3 as N (mg/L)	510	7.1

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ANALYTICAL REPORT

Account No. 331 Date 3-27-84 Lab. No. M84-688

R. L. Henry T452B
C. T. Illsley T452B
R. D. Gaskins 374
N. D. Hoffman T452B
File

Reported by

Approved J. A. Palcic

Sample Description

Solar Evaporation Pond 207B - Samples North and Center

Received 3-20-84

Analysis Results

	North	Center
Gross Alpha (pCi/L)	144 ± 74	6 ± 21
Gross Beta (pCi/L)	45 ± 36	3 ± 24
pH	8.6	11.3
NO_3 as N (mg/L)	570	9.6

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ANALYTICAL REPORT

Account No. 331 Date 3-27-84 Lab. No. M84-635

.. Henry T452B
.. Illsley T452B
.. Gaskins 374
.. Hoffman T452B

Reported by

Approved J. A. Palcic

escription

Solar Evaporation Pond 207B - Samples North and Center

Received 3-13-84

s Results

	North	Center
s Alpha (pCi/L)	151 ± 81	2 ± 16
s Beta (pCi/L)	37 ± 33	13 ± 22
	8.0	9.9
as N (mg/L)	1367	6.7

50 (3-79) PPQC 4-7.3

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ANALYTICAL REPORT

L. Henry - T452B
T. Illsley - T452B
D. Gaskins - 374
D. Hoffman - T452B
e

Account No. 331

Date 3-23-84

Lab. No. M84-573

Reported by

Approved J. A. Palcic

escription
B North and Center Solar Ponds.
eived: 3-6-84

Results

	207B North	201B Center
ss Alpha (pCi/L)	80 ± 42	3 ± 15
ss Beta (pCi/L)	51 ± 40	12 ± 30
	8.2	10.9
as N (mg/L)	569	8.6

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ANALYTICAL REPORT

R. L. Henry - T452B Account No. 331 Date 3-23-84 Lab. No. M84-514
C. T. Illsley - T452B
R. D. Gaskins - 374
M. D. Hoffman - T452B
File

Reported by

Approved J. A. Palcic

Sample Description

207B North Solar Pond. Received 2-28-84

Analysis Results

Analysis	Result
Gross Alpha (pCi/L)	76 ± 33
Gross Beta (pCi/L)	66 ± 41
pH	8.3
NO_3 as N (mg/L)	420

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ANALYTICAL REPORT

To R.L. Henry 452
C.T. Illsley 452
R.D. Gaskins 374
N.D. Hoffman 452
File

Account No. 331 Date 2/29/84 Lab. No. M84-451

Reported by

Approved J.A. Palcic

Sample Description

SOLAR EVAP. POND 207B CENTER & NORTH

Received: 2/21/84

Analysis Results

ANALYSIS	RESULTS	
	North	Center
Gross Alpha (pCi/L)	70±31	6±15
Gross Beta (pCi/L)	34±32	9±22
pH	8.4	10.6
NO_3^- as N	550	8.2

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To
R.L. Henry 452
C.T. Illsley 452
R.D. Gaskins 374
N.D. Hoffman 452
File

Account No. 331

Date 2/27/84

Lab. No. M84-395

Reported by

Approved J.A. Palcic

Sample Description

SOLAR EVAP. POND 207 B NORTH & CENTER

Received: 2/14/84

Analysis Results

ANALYSIS	RESULTS	
	North	Center
pH	8.1	9.7
NO_3^- as N (mg/L)	579	8.6
Gross Alpha (pCi/L)	110±56	2±16
Gross Beta (pCi/L)	25±31	3±24

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ANALYTICAL REPORT

To
R.L. Henry 452
C.T. ILlsley 123
R.D. Gaskins 374
N.D. Hoffman 452
File

Account No. 331 Date 2/16/84 Lab. No. M84-311

Reported by

Approved J.A. Palcic

Sample Description

SOLAR EVAP. POND 207B CENTER

Received: 2/7/84

Analysis Results

ANALYSIS	RESULTS
Alpha (pCi/L)	5±14
Beta (pCi/L)	2±22
pH	9.1
NO_3^- as N (mg/L)	7.1

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ANALYTICAL REPORT

To
R.L. Henry 452
C.T. Illsley 123
R.D. Gaskins 374
N.D. Hoffman 452
File

Account No. 331

Date 2/8/84

Lab. No. M84-248

Reported by

Approved J.A. Palcic

Sample Description

SOLAR EVAP. POND 207B CENTER

Received: 1/31/84

Analysis Results

ANALYSIS	RESULTS
Gross Alpha (pCi/L)	20±23
Gross Beta (pCi/L)	23±26
pH	8.4
NO_3^- as N (mg/L)	5.5

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ANALYTICAL REPORT

Henry 452
Illsley 123
Gaskins 374
Hoffman 452
le

Account No. 331 Date 2/6/84 Lab. No. M84-0182

Reported by

Approved J.A. Palcic

Description

SOLAR EVAP. PONE 207 B CENTER

ceived: 1/24/84
s Results

ANALYSIS	RESULTS
Gross Alpha (pCi/L)	6±12
Gross Beta (pCi/L)	5±25
pH	7.3
NO_3^- as N (mg/L)	10.1

ANALYTICAL REPORT

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File

LAB NUMBER: M85-0949
DATE: 5-24-85
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B (Quarterly Sample) 1) North 1) Center
Received: 4-23-85

Elemental analysis results are reported on attached sheets.

LAB NO: M85-0949
DATE: MAY 23, 1985

ROCKWELL INTERNATIONAL
ENERGY SYSTEMS GROUP
ROCKY FLATS PLANT
881 GENERAL LABORATORY

ANALYSIS REPORT

TO: C.T.ILLSLEY
CC: FILE

BLDG: T 452B
DEPT: ENV. ANALYSIS

CHARGE: 331

SAMPLE DESCRIPTION:

SOLAR POND (NORTH)

EMISSION SPECTROGRAPHIC RESULTS

ELEMENT		Mg/L	ELEMENT		Mg/L
Ag		.082	Mo		<.0041
Al		.16	Na	•	620.0
As	*	<.01	Nb		<.2
B		.29	Ni		<.041
Ba	*	<1.0	P		<.2
Be	*	<.05	Pb		<.0041
Bi		<.02	Rb		<.41
Ca	*	290	Sb		<.041
Cd	*	<.01	Se	*	.02
Ce		<4.1	Si	•	2.1
Co		<.02	Sn		<.041
Cr	*	<.05	Sr		1.2
Cs		<.41	Ta		<.041
Cu		<.02	Te		<.41
Fe		.29	Th		<.041
Ge		<.02	Ti		<.02
Hg	*	<.002	Tl		<.02
K	*	120.0	U		<2
Li		.37	V		<.041
Mg	*	120.0	W		<2
Mn		<.0041	Zn		<.2
			Zr		<.041

• ATOMIC ABSORPTION SPECTROPHOTOMETRIC RESULTS.
** NOT RUN

TOTAL SOLIDS: 4084

ANALYSIS BY: R2D, DLP

PLATE NO: 2994

APPROVED BY R. A. Silva

LAB NO: M85-0949
DATE: MAY 23, 1985

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ENERGY SYSTEMS GROUP
ROCKY FLATS PLANT
881 GENERAL LABORATORY

ANALYSIS REPORT

TO: C.T.ILLSLEY
CC: FILE

BLDG: T 452B
DEPT: ENV. ANALYSIS

CHARGE: 331

SAMPLE DESCRIPTION:

SOLAR POND (CENTER)

EMISSION SPECTROGRAPHIC RESULTS

ELEMENT		Mg/L	ELEMENT		Mg/L
Ag		.015	Mo		.037
Al		.15	Na	•	250.0
As	*	<.01	Nb		<.037
B		.67	Ni		.015
Ba	*	<1.0	P		.074
Be	*	<.05	Pb		<.0007
Bi		<.0037	Rb		<.074
Ca	*	45.0	Sb		<.0074
Cd	*	<.01	Se	•	<.01
Ce		<.74	Si	*	5.5
Co		<.0037	Sn		<.0074
Cr	*	<.05	Sr		.52
Cs		<.074	Ta		<.0074
Cu		.037	Te		<.074
Fe		.074	Th		<.0074
Ge		<.0037	Ti		.022
Hg	•	<.002	Tl		<.0037
K	*	36.0	U		<.37
Li		.052	V		<.0074
Mg	•	13.0	W		<.37
Mn		.022	Zn		<.037
			Zr		<.0074

* ATOMIC ABSORPTION SPECTROPHOTOMETRIC RESULTS.
** NOT RUN

TOTAL SOLIDS: 744

ANALYSIS BY: R2D,DLP

PLATE NO: 2994

APPROVED BY R. A. Schue

ANALYTICAL REPORT

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R. D. Gaskins, Liq Wste 374
T. Greengard, HS&E T452B
File

LAB NUMBER: M84-2608
DATE: 11-28-84
ACCOUNT NO: 331

APPROVED: J. A. Blair

SAMPLE DESCRIPTION

Solar Evaporation Pond 207B 1) North 2) Center
Received: 10/23/84

ANALYSIS RESULTS

Elemental analysis results are reported on attached sheets.

LAB NO: M84-2606
DATE: NOVEMBER 21,1984

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ROCKY FLATS PLANT
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ANALYSIS REPORT

TO: R.L.HENRY
CC: FILE

BLDG: T452B
DEPT: ENV.ANALYSIS

CHARGE: 331

SAMPLE DESCRIPTION:

SOLAR POND B (CENTER)

EMISSION SPECTROGRAPHIC RESULTS

ELEMENT		Mg/L	ELEMENT		Mg/L
Ag		.0016	Mo		.016
Al		2	Na	•	67.0
As	•	<.01	Nb		<.02
B		.24	Ni		.016
Ba	*	<1.0	P		.2
Be	*	<.05	Pb		.002
Bi		<.002	Rb		.041
Ca	•	2.9	Sb		<.0041
Cd	•	<.01	Se	•	<.01
Ce		<.41	Si	•	2.4
Co		<.002	Sn		<.0041
Cr	•	<.05	Sr		.28
Cs		.041	Ta		<.0041
Cu		.016	Te		<.041
Fe		.2	Th		<.0041
Ge		<.002	Ti		.041
Hg	•	<.002	Tl		<.002
K	*	30.0	U		<.2
Li		.41	V		.0081
Mg	•	3.9	W		<.2
Mn		.081	Zn		.041
			Zr		.0041

* ATOMIC ABSORPTION SPECTROPHOTOMETRIC RESULTS.
** NOT RUN

TOTAL SOLIDS: 406

ANALYSIS BY: R2D,DLP

PLATE NO: 2884

APPROVED BY R. A. Silva

LAB NO: M84-2608
DATE: NOVEMBER 21,1984

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ANALYSIS REPORT

TO: R.L.HENRY
CC: FILE

BLDG: T452B
DEPT: ENV.ANALYSIS

CHARGE: 331

SAMPLE DESCRIPTION:

SOLAR POND B (NORTH)

EMISSION SPECTROGRAPHIC RESULTS

ELEMENT		Mg/L	ELEMENT		Mg/L
Ag		<.0035	Mo		.0069
Al		1	Na	•	370.0
As	*	<.01	Nb		<.17
B		.31	Ni		<.035
Ba	*	<1.0	P		<.17
Be	•	<.05	Pb		.0035
Bi		<.017	Rb		<.35
Ca	*	20.0	Sb		<.035
Cd	•	<.01	Se	•	.01
Ce		<3.5	Si	•	5.6
Co		<.017	Sn		<.035
Cr	•	<.05	Sr		3.5
Cs		<.35	Ta		<.035
Cu		<.017	Te		<.35
Fe		.28	Th		<.035
Ge		<.017	Ti		.069
Hg	•	<.002	Tl		<.017
K	*	82.0	U		<1.7
Li		3.5	V		<.035
Mg	•	87.0	W		<1.7
Mn		<.035	Zn		<.17
			Zr		<.035

* ATOMIC ABSORPTION SPECTROPHOTOMETRIC RESULTS.
** NOT RUN

TOTAL SOLIDS: 3459

ANALYSIS BY: R2D, DLP

PLATE NO: 2884

APPROVED BY R. A. Schuman

ATTACHMENT 2

1986 SAMPLING DATA

INTRODUCTION

The results presented herein are for samples from Pond 207-B North, the interceptor trench pump house, the buffer zone and the West Spray Field collected in April and May 1986. The interceptor trench pump house was resampled in August 1986.

The samples are generally designated by a three character code. The last character designates the analytical sample code as shown in Table A. The remaining portion of the codes are as follows:

Pond 207-B North liquid is designed by a prefix 207B and a two character code. The first character of the code is the same as described for the Pond 207-A liquid samples. The meaning of the second character is shown in Table A.

TABLE A
ANALYTICAL SAMPLE CODE

Sample Type	Code	Designation
Water	1	Volatiles
	2	Semi-Volatiles
	3	Metals
	4	Cyanide
	5	Phenolics
	6	RCRA Waste Characterization
	7	Radiochemistry
	8	Tritium
Soil/Sediment	1	Volatiles
	2	Semi-Volatiles
	3	Metals and Cyanide
	4	RCRA Waste Characteristics
	5	Radiochemistry

LIQIUDS

For samples from the interceptor trench pump house, the first character, L, indicates a liquid sample. The liquid was sampled in triplicate, A, B, or C, designated by the second character. A second character of 0 (zero) indicates a field blank sample. In the resampling, the sample code has a prefix of ITPH.

For samples taken from monitoring wells near the West Spray Field, the first three characters designate the well. Wells 6-82 and 9-81 were the only wells sampled in the 1986 study. The wells were sampled in triplicate, A, B, or C, designated by the fourth character of the sample name. A fourth character of 0 (zero) indicates a field blank.

SOILS AND SEDIMENTS

For samples from the interceptor trench pump house, the first characters, S, indicates a sediment sample. The second character, A or B, indicates the initial or duplicate sample, respectively. In the resampling, the sample code has a prefix of ITPH. The meaning of the third character is shown in Table A.

Samples from the buffer zone are designated by a three character code. The first character of the code indicates the composite sample number, 1, 2, or 3. The second character, A, B or C, indicates the sample depth. A surface scrape is designated by A, a sample from 0 to 6 inches is designated by B and a sample from 6 to 12 inches by C.

The samples from the West Spray Field are similar in designation to those samples taken in the Buffer Zone. The only exception is in the second character which is either a D, E, or F to indicate sample depth. A surface scrape is designed by D, a sample from 0 to 6 inches is designated by E, and a sample from 6 to 12 inches by F.

WESTON

SEP 29 [illegible]

VOA ORGANIC ANALYTICAL DATA PACKAGE FOR ROCKY FLATS

DATE RECEIVED: August 21, 1986

SAMPLE DESCRIPTION	WESTON ID R.F.W. NUMBER	DATE COLLECTED	VOA ANALYSIS
ITPH-LAI	8608-682-0070	8/19/86	9/01/86
ITPH-SAI	8608-682-0080	8/19/86	9/01/86
ITPH-LB1	8608-682-0240	8/19/86	9/01/86
ITPH-LC1	8608-682-0250	8/19/86	9/01/86
ITPH-SB1	8608-682-0260	8/19/86	9/01/86

Rear

WESTON ANALYTICS
GC/MS DATA SUMMARY
VOLATILE HAZARDOUS SUBSTANCE LIST COMPOUNDS

RFW Batch Number: 8608-682- Client: ROCKY FLATS Page: 1

Sample Information	Cust ID:	ITPH-LAI		LAB DUP		MS		ITPH-SAI		ITPH-LBI		ITPH-LCI	
	RFW#:	0070		0070		0070		0080		0240		0250	
	Matrix:	Water		Water		Water		Water		Water		Water	
	D.F.:	1		1		1		1		1		1	
	Units:	ug/l		ug/l		ug/l		ug/l		ug/l		ug/l	
			fl		fl		fl		fl		fl		f
Chloromethane		1	U	1	U	1	U	1	U	1	U	1	U
Bromomethane		1	U	1	U	1	U	1	U	1	U	1	U
Vinyl Chloride		1	U	1	U	1	U	1	U	1	U	1	U
Chloroethane		1	U	1	U	1	U	1	U	1	U	1	U
Methylene Chloride		4	U	4	U	4	U	4	U	4	U	4	U
Acetone		2	U	2	U	2	U	2.5		2	U	2	U
Carbon Disulfide		1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethene		1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethane		1	U	1	U	1	U	1	U	1	U	1	U
Trans-1,2-Dichloroethene		1	U	1	U	1	U	1	U	1	U	1	U
Chloroform		1.2		1	U	89	%	6.9		1.4		1	U
1,2-Dichloroethane		1	U	1	U	1	U	1	U	1	U	1	U
2-Butanone		1	U	1	U	1	U	1	U	1	U	1	U
1,1,1-Trichloroethane		1	U	1	U	1	U	1	U	3.1		4.8	
Carbon Tetrachloride		1	U	1	U	1	U	1	U	1.6		2.1	
Bromodichloromethane		1	U	1	U	69	%	1	U	1	U	1	U
1,2-Dichloropropane		1	U	1	U	1	U	1	U	1	U	1	U
Trans-1,3-Dichloropropene		1	U	1	U	1	U	1	U	1	U	1	U
Trichloroethene		3.7		2.2		2.9		1	U	2.5		2.4	
Dibromochloromethane		2	U	2	U	97	%	2	U	2	U	2	U
1,1,2-Trichloroethane		1	U	1	U	1	U	1	U	1	U	1	U
Benzene		1	U	1	U	1	U	1	U	1	U	1	U
cis-1,3-Dichloropropene		1	U	1	U	1	U	1	U	1	U	1	U
2-Chloroethylvinylether		2	U	2	U	2	U	2	U	2	U	2	U
Bromoform		4	U	4	U	4	U	4	U	4	U	4	U
4-Methyl-2-pentanone		1	U	1	U	1	U	1	U	1	U	1	U

RFW Batch Number: 8608-682- Client: ROCKY FLATS Page:

Cust ID: / RFW#:	ITPH-LAI 0070		LAB DUP 0070		MS 0070		ITPH-SAI 0080		ITPH-LBI 0240		ITPH-LCI 0250	
		fl		fl		fl		fl		fl		fl
Tetrachloroethene	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2,2-Tetrachloroethane	1	U	1	U	1	U	1	U	1	U	1	U
Toluene	1	U	1	U	1	U	1	U	1	U	1	U
Chlorobenzene	1	U	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	1	U	1	U	1	U	1	U	1	U	1	U
Styrene	1	U	1	U	1	U	1	U	1	U	1	U
Total Xylenes	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichlorobenzene	1	U	1	U	1	U	1	U	1	U	1	U
1,3-Dichlorobenzene	1	U	1	U	1	U	1	U	1	U	1	U
1,4-Dichlenzenes	1	U	1	U	1	U	1	U	1	U	1	U
Trichlorofluoromethane	1	U	1	U	1	U	1	U	1	U	1	U
Dichlorodifluoromethane	1	U	1	U	1	U	1	U	1	U	1	U

U=Analyzed, not detected. B=Present in blank. NRP=Not Reported
J=Present at less than detection limit. NR=Not requested.

WESTON ANALYTICS
GC/MS DATA SUMMARY
VOLATILE HAZARDOUS SUBSTANCE LIST COMPOUNDS

RFW Batch Number: 8608-682- Client: ROCKY FLATS

Sample Information	Cust ID:	ITPH-SB1	BLANK	BS
	RFW#:	0260	BLANK	BS
	Matrix:	Water	Water	Water
	D.F.:	1	1	1
	Units:	ug/l	ug/l	ug/l
Chloromethane		1 U	1 U	1 U
Bromomethane		1 U	1 U	1 U
Vinyl Chloride		1 U	1 U	1 U
Chloroethane		1 U	1 U	1 U
Methylene Chloride		4 U	4 U	4 U
Acetone		2.2	2 U	2 U
Carbon Disulfide		1 U	1 U	1 U
1,1-Dichloroethene		1 U	1 U	1 U
1,1-Dichloroethane		1 U	1 U	1 U
Trans-1,2-Dichloroethene		1 U	1 U	1 U
Chloroform		1 U	1 U	1 U
1,2-Dichloroethane		1 U	1 U	1 U
2-Butanone		1 U	1 U	1 U
1,1,1-Trichloroethane		1 U	1 U	1 U
Carbon Tetrachloride		29	1 U	1 U
Bromodichloromethane		1 U	1 U	1 U
1,2-Dichloropropane		1 U	1 U	1 U
Trans-1,3-Dichloropropene		1 U	1 U	1 U
Trichloroethene		1 U	1 U	1 U
Dibromochloromethane		2 U	2 U	2 U
1,1,2-Trichloroethane		1 U	1 U	1 U
Benzene		1 U	1 U	113 %
cis-1,3-Dichloropropene		1 U	1 U	1 U
2-Chloroethylvinylether		2 U	2 U	2 U
Bromoform		4 U	4 U	4 U
4-Methyl-2-pentanone		1 U	1 U	1 U

RFW Batch Number: 8608-682- Client: ROCKY FLATS Page:

	Cust ID:	ITPH-SB1	BLANK	BS			
	RFW#:	0260	BLANK	BS			
		fl	fl	fl	fl	fl	
Tetrachloroethene		1 U	1 U	1 U			
1,1,2,2-Tetrachloroethane		1 U	1 U	1 U			
Toluene		1 U	1 U	1 U			
Chlorobenzene		1 U	1 U	1 U			
Ethylbenzene		1 U	1 U	1 U			
Styrene		1 U	1 U	1 U			
Total Xylenes		1 U	1 U	114 %			
1,2-Dichlorobenzene		1 U	1 U	1 U			
1,3-Dichlorobenzene		1 U	1 U	1 U			
1,4-Dichlenzenes		1 U	1 U	1 U			
Trichlorofluoromethane		1 U	1 U	1 U			
Dichlorodifluoromethane		1 U	1 U	1 U			

U=Analyzed, not detected. B=Present in blank. NRP=Not Reported
J=Present at less than detection limit. NR=Not requested.

ATTACHMENT 3

RECENT GROUNDWATER

ANALYTICAL DATA

Station	Al ug/l	Sb ug/l	As ug/l	Ba ug/l	Be ug/l	Cd ug/l	Cs ug/l	Cr ug/l	Co ug/l	Cu ug/l	Fe ug/l	Pb ug/l	Mn ug/l	Hg ug/l	Mo ug/l	Ni ug/l	Se ug/l	Ag ug/l	Sr ug/l	Tl ug/l	V ug/l	Zn ug/l
Ground Water: Plant Site Alluvial Wells Upgradinet																						
47-86	ND	ND	ND	100	ND	7	ND	ND	ND	ND	ND	ND	86	ND	ND	ND	ND	ND	ND	ND	47	ND
51-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
53-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
55-86	740	58		140	11	ND	ND	ND	ND	ND	537	ND	547	ND	ND	ND	ND	ND	154	ND	ND	7
10-81	680	ND	ND	ND	37	ND	360	ND	100	ND	270	ND	ND	0.7	510	77	ND	ND	68	7	850	20
Ground Water: Plant Site Bedrock Wells Upgradient																						
46-86	350	ND	ND	144	ND	ND	ND	ND	ND	132	ND	13	ND	ND	ND	9	ND	117	ND	ND	ND	ND
52-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
54-86	150	ND	ND	ND	ND	ND	ND	15	ND	ND	110	ND	100	ND	ND	ND	ND	ND	326	ND	ND	ND
Ground Water: West Spray Field Alluvial Wells Upgradient																						
10-81	680	ND	ND	ND	37	ND	360	ND	100	ND	270	ND	ND	0.7	510	77	ND	ND	68	7	850	20
7-82	Dry																					
51-86	ND	ND	ND	110	ND	6	ND	27	ND	23	ND	ND	71	ND	ND	29	ND	ND	ND	ND	ND	39
Ground Water: West Spray Field Alluvial Wells Downgradient																						
50-86	190	ND	ND	190	ND	ND	ND	ND	ND	ND	181	54	347	ND	ND	ND	ND	ND	164	ND	ND	63
49-86	ND	ND	ND	116	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	205	ND	ND	ND
5-82	ND	ND	ND	150	ND	ND	ND	ND	ND	ND	ND	ND	30	1.2	ND	ND	ND	180	14	ND	ND	1,580
6-82	ND	ND	ND	290	40	ND	ND	22	ND	ND	180	16	140	ND	ND	60	ND	ND	ND	ND	ND	102
45-86	480	ND	ND	160	11	ND	ND	ND	ND	ND	252	ND	79	0.21	ND	ND	ND	ND	190	ND	ND	6
9-81	ND	ND	ND	ND	ND	ND	ND	7.5	ND	ND	6	ND	0.22	ND	ND	ND	ND	ND	350	19	ND	90
3-82	ND	ND	ND	280	40	ND	ND	16	ND	20	ND	ND	80	ND	ND	ND	17	ND	110	ND	ND	75
Ground Water: West Spray Field Bedrock Wells Upgradient																						
52-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Bedrock Wells Downgradient																						
8-81	ND	ND	ND	ND	80	ND	ND	13	ND	30	ND	ND	ND	ND	ND	ND	8.2	ND	250	ND	ND	ND
48-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

ND = Not Detected; NA = Not Available.

Detected Volatiles

Station	1,1 DCE (ug/l)	1,1 DCA (ug/l)	t,1,2-DCE (ug/l)	CHCl3 (ug/l)	1,2 DCA (ug/l)	MEK (ug/l)	1,1,1 TCA (ug/l)	CCL4 (ug/l)	TCE (ug/l)	1,1,2 TCA (ug/l)	PCE (ug/l)
Ground Water: Plant Site Alluvial Wells Upgradient											
47-86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
51-86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
53-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
55-86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10-81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ground Water: Plant Site Bedrock Wells Upgradient											
46-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
52-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
54-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Alluvial Wells Upgradient											
10-81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
51-86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ground Water: West Spray Field Alluvial Wells Downgradient											
50-86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
49-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5-82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6-82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
45-86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9-81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ground Water: West Spray Field Bedrock Wells Upgradient											
52-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Bedrock Wells Downgradient											
8-81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
48-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = Not Available; ND = Not Detected.

Radio Chemistry

Station	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Plutonium (pCi/l)	Americium (pCi/l)	U-233,234 (pCi/l)	U-238 (pCi/l)	Tritium (pCi/ml)
Ground Water: Plantsite Alluvial Wells Upgradient							
47-86	NA	NA	NA	NA	NA	NA	NA
51-86	NA	NA	NA	NA	NA	NA	NA
53-86	NA	NA	NA	NA	NA	NA	NA
55-86	170 ± 70	130 ± 30	-0.05 ± 0.07	-0.02 ± 0.04	5.4 ± 0.5	6.7 ± 0.6	0.20 ± 0.22
10-81	22 ± 7	22 ± 3	0.03 ± 0.06	0.03 ± 0.04	0.96 ± 0.24	0.59 ± 0.19	0.33 ± 0.23
Ground Water: Plantsite Bedrock Wells Upgradient							
46-86	NA	NA	NA	NA	NA	NA	NA
52-86	NA	NA	NA	NA	NA	NA	NA
54-86	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Alluvial Wells Upgradient							
10-81	22 ± 7	22 ± 3	0.03 ± 0.06	0.03 ± 0.04	0.96 ± 0.24	0.59 ± 0.19	0.33 ± 0.23
7-82	NA	NA	NA	NA	NA	NA	NA
51-86	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Alluvial Wells Downgradient							
50-86	NA	NA	NA	NA	NA	NA	NA
49-86	NA	NA	NA	NA	NA	NA	NA
5-82	2 ± 3	3 ± 2	-0.03 ± 0.04	0.05 ± 0.05	-0.01 ± 0.04	0.00 ± 0.01	-0.03 ± 0.22
6-82	79 ± 39	110 ± 30	0.05 ± 0.17	0.03 ± 0.07	4.0 ± 0.6	3.7 ± 0.6	-0.01 ± 0.22
45-86	200 ± 80	140 ± 30	0.13 ± 0.21	0.03 ± 0.07	11 ± 1	10 ± 1	0.10 ± 0.22
9-81	4 ± 5	4 ± 3	-0.03 ± 0.04	0.04 ± 0.04	0.57 ± 0.17	0.25 ± 0.11	0.00 ± 0.22
3-82	10 ± 7	17 ± 6	-0.07 ± 0.10	0.00 ± 0.04	0.54 ± 0.29	0.44 ± 0.27	0.14 ± 0.22
Ground Water: West Spray Field Bedrock Wells Upgradient							
52-86	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field bedrock Wells Downgradient							
8-81	5 ± 4	2 ± 3	0.16 ± 0.10	0.00 ± 0.04	3.2 ± 0.4	1.7 ± 0.3	0.02 ± 0.22
48-86	NA	NA	NA	NA	NA	NA	NA
Ground Water: Landfill Alluvial Wells Upgradient							
WS-1	8 ± 5	10 ± 3	0.08 ± 0.16	0.02 ± 0.04	0.53 ± 0.20	0.30 ± 0.15	-0.04 ± 0.24
10-86	NA	NA	NA	NA	NA	NA	NA

ND = Not Detected; NA = Not Available.

Other Inorganic

Station	Calcium ug/l	Magnesium ug/l	Potassium ug/l	Sodium ug/l	Bicarbonate mg/l	Carbonate mg/l	Chloride mg/l	Cyanide mg/l	Phosphate mg/l	Sulfate mg/l	Nitrate mg/l
Ground Water: Plantsite Alluvial Wells Upgradient											
47-86	15,400	2,230	ND	16,4000	5.4	88	2.9	ND	8.7	20	<5.0
51-86	12,300	1,920	1,070	21,400	ND	42	7.3	ND	4.7	31	18.4
53-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
55-86	22,800	4,280	4,700	8,770	17	76	7.4	ND	3.3	22	<5.0
10-81	18,000	6,600	560	11,000	19	21	5.7	0.0016	1.3	ND	<5.0
Ground Water: Plantsite Bedrock Wells Upgradient											
46-86	13,900	1,190	7,200	31,400	NA	NA	NA	NA	NA	NA	NA
52-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
54-86	43,300	10,400	6,030	36,800	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Alluvial Wells Upgradient											
10-81	18,000	6,600	560	11,000	19	21	5.7	0.0016	1.3	ND	<5.0
7-82	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
51-86	NA	NA	NA	NA	NS	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Alluvial Wells Downgradient											
50-86	30,000	5,430	1,490	12,100	130	ND	7.6	ND	2.0	16	37.4
49-86	35,200	7,640	ND	29,500	NA	NA	NA	NA	NA	NA	NA
5-82	36,200	4,130	15,500	23,300	56	ND	55	ND	0.92	77	32.4
6-82	8,700	1,200	ND	5,100	15	22	3.3	ND	1.5	20	<5.0
45-86	26,200	5,900	623	13,400	12	110	6.1	ND	4.7	14	<5.0
9-81	28,200	1,480	5,880	15,900	NA	NA	NA	NA	NA	NA	<5.0
3-82	22,000	3,680	ND	13,800	10	19	15	ND	1.8	28	74.7
Ground Water: West Spray Field Bedrock Wells Upgradient											
52-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ground Water: West Spray Field Bedrock Wells Downgradient											
8-81	73,300	5,780	ND	13,800	4.9	130	8.6	0.005	ND	17	<5.0
48-86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

ND = Not Detected
NA = Not Available

ATTACHMENT 4

SOIL SAMPLING STATISTICS

Soil Sampling Stats

Reference: USEPA. "Preparation of Soil Sampling Protocol: Technique and Strategies, "U.S. Environmental Protection Agency, EPA-600/4-83-020, 1983.

Page 25 of the above reference gives:

$$h = \frac{CV^2 \, t\alpha^2}{p^2} \quad \text{Where}$$

n = # of samples

CV = Coefficient of variance = $\frac{\text{Std.Dev.}}{\text{mean}} \times 100\%$

$t\alpha$ = t statistic at given confidence level with n-1 degrees of freedom

p = $D/\bar{y} \times 100\%$ = measure of precision of results

D = Precision of analytical results (typically $\pm$ 10 ppm as per USEPA)

$\bar{y}$ = Mean of contaminant from soil samples taken to date

For lead in Buffer Zone Soil and West Spray Field Soil (Surface scrape only):

Pb (mg/kg): 38, 48, 42, 61, 63, 42

$\bar{y}$ = 49

S = standard deviation = 10.58

$$CV = \frac{10.58}{49} \times 100\% = 21.592\%$$

$D/\bar{y}$ = 10/49 x 100% = 20.41%

$t\alpha$ for n-1 = 5 at 90% confidence level (two-tailed) = 2.015

$$n = \frac{(21.592)^2 \, (2.015\ 2)^2}{(20.41)^2} = 4.54 \text{ Samples}$$

Therefore, take 5 samples per area to be investigated to have a valid data base for statistics, assuming data distribution is approximately the same as found to date.

ATTACHMENT 5

LEACHING PROCEDURES

MOBILE CONTAMINANT FRACTION LEACHING TESTS

Introduction

Leaching tests can be used to evaluate the leachable contaminants in solid waste, the binding of contaminants in solid waste, or the attenuation of contaminants from a liquid passing through a soil. These tests cannot accurately represent all of reactions that occur in the field, and therefore data analysis is important.

Batch leaching tests will be used in this study to assess the movement of inorganic parameters, since research has shown large variations in data results, for identical column leachings of identical waste (3, 4, 5, 7). It is conjectured that the cause of these analytical variations is due to the effect of channel flow in the soil columns (1, 7). Additionally, column tests are more expensive, more time consuming, and the data is unreproducible (1, 7). The batch leaching tests for this study will be run at approximate solid to liquid ratios of 1 to 6. The low concentrations of contaminants found in Rocky Flats soil to date suggests the use of less dilute solid to liquid ratios than 1 to 20 (as specified in the EP Toxicity Characteristic leaching test) so that contaminant concentrations will be above analytical detection limits in the artificial leachate. Three successive leachings of the same soil with deionized water will be employed in order to study the release pattern of contaminants, as well as to determine any serial leaching of contaminants. At the end of these leachings, a cumulative solid to liquid ratio of 1 to 18 will have been experienced by the soil. Three to five

leachings of the same soil or waste has been determined to yield the majority of release data on contaminants in batch leaching studies (1, 3, 5).

Procedures

All locations at which soil samples for total chemical analysis are taken will have identical split samples taken for batch leaching studies. These batch leaching samples will be homogenized and a 100 gram aliquot used for analysis. A second 100 gram aliquot will be be used in percent moisture determinations. The remainder of the sample will be labeled and held awaiting further analysis.

The 100 gram soil aliquot for leaching tests will be placed in a clean 2 liter glass container and mixed with 600 milliliters of deionized water. A tight fitting cap with a teflon septum will be placed on the container, and the sample subjected to 24 hours of rotational leaching at approximately 15 RPM. After 24 hours of leaching, the sample will be allowed to settle, and all liquids filtered through a .45 micron filter. The resultant artificial leachate will then be analyzed for the indicator parameters of concern. The soil will then be releached for 24 hours twice more with fresh 600 milliliter portions of deionized water. These two succeeding artificial leachates will also be analyzed for the indicator parameters. After three leachings, the soil will be discarded.

Data Analysis

The leaching test data for contaminated soil samples at one sampling location will be compared with the total contaminant present in the soil at that sampling location. Leachable fraction ratios (l_{Fi}) will be developed as follows:

$$l_{Fi} = \frac{(C_{i1} \times .6) + (C_{i2} \times .6) + (C_{i3} \times .6) \quad (mg/ug)}{C_{si} \times .1}$$

C_{i1} = Concentration of indicator parameter (i) in aqueous solution from leaching test number 1 (mg/L)

C_{i2} = Concentration of indicator parameter (i) in aqueous solution from leaching test number 2 (mg/l)

C_{i3} = Concentration of indicator parameter (i) in aqueous solution from leaching test number 3 (mg/l)

C_{si} = Concentration of indicator parameter (i) in soil matrix from total contaminant digestion (mg/kg), adjusted for percent moisture

The l_{Fi} of each contaminated sample will be combined with the l_{Fi} of all other contaminated samples and a mean L_{Fi} will be developed. This resultant LFi will be used to assess the the aqueous phase source term for each indicator parameter in a contaminated area. The L_{Fi}, along with the three successive l_{Fis} will provide knowledge of the total leachable fraction of any contaminant, as well as the expected release pattern. These LFi values will tend to overestimate the release of contaminants for the following reasons:

1. The ionic strength (I) of deionized water is lower than the I of rainwater. This will cause relatively more contaminants to be driven into the aqueous phase in the leaching test than in the field.

2. The agitation during the leaching test will cause intimate and complete water/soil interaction. The soil surface will be completely in contact with water, and the formation of concentration gradients in the liquid will be prevented.

The portion of any indicator parameter not released from a contaminated soil sample in the three batch leaching tests will be considered non-leachable. The difference between the means of the non-leachable parameter fraction of contaminated soil samples and the mean of the parameter concentration in uncontaminated soils will be used to assess the attenuative capacity of underlying uncontaminated soils through which leachate would migrate.

The total attenuative capacity of the noncontaminated soil (a mass of a contaminant) will be defined using the attenuative capacity of the uncontaminated soil as defined above, along with the mass of uncontaminated soil between the site under investigation and the high groundwater table. The total attenuative capacity of the soil in the field is 20% of that as determined in the laboratory batch leaching tests. The entire soil surface area is exposed to liquid in the batch leaching tests, whereas due to tortuosity of the pore connections of in-situ soil only 20% of the soil surfaces are in contact with pore fluid under typical unsaturated flow conditions (8). If the total field attenuative capacity of the underlying soil is greater than the total amount of an inorganic indicator contaminant released by overlying contaminated soil (as determined by batch leaching tests), then groundwater degradation is not possible. If groundwater degradation is possible, then additional studies will be conducted. These studies could include additional groundwater monitoring wells, additional geologic work, risk assessment, groundwater modeling, or related work.

References

1. Ham, Et al. Background Study on the Development of a Standard Leaching Test. U.S.E.P.A., Industrial Environmental Research Laboratory, EPA-600/2-79-109, May, 1979.

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3. Krapac, Et al. "Evaluation of Laboratory Produced Leachates Used for Environmental Assessment of Coal Refuse." Symposium on Surface Mining Hydrology, Sedimentology and Reclamation. University of Kentucky - Lexington, 1981.

4. Krapac, Et al. Collection of Representative Coal Refuse Samples for Leachate Generation Studies. Office of Surface Mining, Eastern Technical Center, Pittsburg, Pennsylvania, 1983.

5. Kunes, T. Development of a Standard Leaching Test of Foundry Process Waste. M.S. Thesis, Department of Civil and Environmental Engineering, University of Wisconsin - Madison, 1975.

6. Kmet, P. Moisture Routing Characteristics of Foundry Wastes. M.S. Report Department of Civil and Environmental Engineering, University of Wisconsin - Madison, 1977.

7. Jackson, Et al. "Comparison of Batch and Column Methods for Assessing Leachability of Hazardous Waste," Environmental Science and Technology, Volume 18, No.9, September 1984.

8. Doran, F. J. and Thresher, J. E., Jr. "Prediction of the fate of Chromium from a Proposed Municipal Sanitary Landfill." Presented at NWWA Conference Solving Groundwater Problems with Models, February 10-12, 1987, Denver, Colorado.

ATTACHMENT 6

QA/QC

1. LABORATORY QA/QC PROGRAM

This appendix to the quality assurance/quality control plan describes the organization and procedures used to produce reliable analytical data. These procedures are applicable to performing chemical, radiological, and geotechnical analyses on waste or environmental samples as appropriate.

The ultimate responsibility for the generation of reliable laboratory data rests with the laboratory management. Laboratory management is vested with the authority to establish those policies and procedures to ensure that only data of the highest attainable caliber are produced. Laboratory management, as well as the laboratory Quality Assurance/Quality Control Officer are responsible for the implementation of the established policies and procedures.

Laboratory management has the following responsibilities:

- direct implementation of the quality assurance program,
- ensure that their personnel are adequately trained to perform analyses,
- ensure that equipment and instrumentation under their control are calibrated and functioning properly, and
- review and perform subsequent corrective action on internal and external audits.

The Quality Assurance/Quality Control Officer has the following responsibilities:

- on-going review of individual quality assurance procedures,
- providing assistance in the development and implementation of specific quality assurance plans for special analytical programs,
- coordination of internal and external quality assurance audits,
- coordination of quality assurance training,
- review of special project plans for consistency with organizational requirements and advising laboratory management of inconsistencies, and
- overall coordination of the laboratories' quality assurance program manual.

1.2. SAMPLE MANAGEMENT

On notification of the sampling and analyses effort, the laboratory will create a file to maintain records associated with the activity. In addition to administrative information, requests for sample containers, preservatives, and required analyses will be included in the file.

Sample bottles will be prepared by the laboratory and made available to the sampling team. The bottles will be prepared according to the analysis plan procedures and will include sample preservatives appropriate to the analytes and matrices of concern. Addition of preservatives to sample shall be recorded on chain-of-custody forms.

Samples received at the laboratories will be inspected for integrity, and any field documentation will be reviewed for accuracy and completeness.

Chain-of-custody and sample integrity problems will be noted and recorded on the chain-of-custody forms during sample log-in. Chain-of-custody forms and deficiency notices will be maintained in the file. Any deficiencies will be brought to the attention of the Rockwell International CEARP Manager who will advise the laboratory on the desired disposition of the samples.

Each sample that is received by the laboratory will be assigned a unique sequential sample number which will identify the sample in the laboratory's internal tracking system. References to a sample in any communication will include the assigned sample number.

Samples will be stored in a locked refrigerator at $4^{o}C$. The temperature of the storage refrigerators will be monitored and recorded daily by the sample custodian. Sample fractions and extracts will also be stored under these same conditions.

1.3. ANALYTICAL SYSTEMS

1.3.1. Instrument Maintenance

Instruments will be maintained in accordance with manufacturers' specifications. More frequent maintenance may be dictated dependent on operational performance. Instrument logs will be maintained to document the date, type, and reason for any maintenance performed.

Contracts on major instruments with manufacturers and service agencies may be used to provide routine preventive maintenance and to ensure rapid response to emergency repair service.

1.3.2. Instrument Calibration

Before any instrument is used, it will be calibrated using known reference materials. All sample measurements will be made within the calibrated range of the instrument. A record of calibration will be kept in an equipment log.

1.3.3. Personnel Training

Prior to conducting analyses on an independent basis, analysts will be trained by experienced personnel in the complete performance of the analytical method. Analysts may require training at instrument manufacturers' training courses. The analyst will be required to independently generate data on several method and/or matrix spikes to demonstrate proficiency in that analytical method. The type of data to be generated will be dependent on the analytical method to be performed. Results of this "certification" will be reviewed by laboratory management for adequacy.

Method blanks and method spikes will be required in every lot of samples analyzed, thus performance on a day-to-day basis can be monitored. Laboratory management and the Laboratory Quality Assurance/Quality Control Officer are responsible for ensuring that samples are analyzed by only competent analysts.

1.4. ANALYTICAL METHODS

1.4.1. Gas Chromatography/Mass Spectroscopy

Mass spectrometers will be tuned on a daily basis to manufacturer's specifications with FC-43. In addition, once per shift (8 hours) these instruments will be tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for semi-volatiles or volatiles, respectively. Ion abundance will be within the window dictated by the requirements of the specific protocols. Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) will be generated for at least three solutions containing known concentrations of authentic standards of compounds of concern.

The calibration curve will bracket the anticipated working range of analyses.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

During each operating shift, a midpoint calibration standard will be analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be those analytes used in the EPA contract laboratory program's multicomponent analyses (e.g., priority pollutants and hazardous substances list) with the exception that benzene will be used in place of vinyl chloride (volatiles) and di-n-octyl phthalate will be deleted from the semi-volatile list.

The response factor drift will be calculated and recorded. If significant (>30%) response factor drift is observed, appropriate corrective action will be taken to restore confidence in the instrumental measurements.

All GC/MS analyses will include analyses of a method blank, a method spike, and a method spike duplicate in each lot of samples. In addition, appropriate surrogate compounds specified in EPA methods will spiked into each sample. Recoveries from method spikes and surrogate compounds will be calculated and recorded on control charts to maintain a history of system performance.

Duplicate samples will be analyzed for analytical lots of twenty (20) or more samples.

Audit samples will be analyzed periodically to compare and verify laboratory performance against standards prepared by outside sources.

1.4.2. Gas Chromatography and High Performance Liquid Chromatography

Gas chromatographs and high performance liquid chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of three concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of "known" versus "found" concentrations must be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A midpoint calibration check standard will be analyzed each operating shift (8 hours) to confirm the validity of the initial calibration curve. The check standard must be within twenty (20) percent of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determined if contamination is being introduced in the laboratory. The method spikes will be examined to determine both precision and accuracy.

Accuracy will be measured by the percent recovery of the spikes; precision will be measured by the reproducibility of method spikes.

1.4.3. Atomic Absorption Spectrophotometry

Atomic absorption spectrophotometers will be calibrated prior to each day of use.

Calibration standards will be prepared from appropriate reference materials, and working calibration standards will be prepared fresh weekly. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement.

Duplicate injections will be made for each concentration. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of "known" versus "found" concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory and will be introduced at a frequency of one per analytical lot or five (5) percent of the samples, whichever is more. The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range of 75-125 percent to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within twenty (20) percent in order to be considered acceptable.

1.4.4. Spectrophotometric Methods

Spectrophotometers will be calibrated prior to each day of use. Calibration standards will be prepared from reference materials appropriate to the analyses being performed, and working standards will include a blank and a minimum of five (5) concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of "known" versus "found" concentration will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to the analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

Accuracy will be measured by the percent recovery of the spikes. The recovery must be in an acceptable range (based on EPA data for the method of interest) in order to be considered acceptable. Precision will be measured by the reproducibility of both method spikes.

Results must agree within acceptable limits (based on EPA data) in order to be considered acceptable.

1.5. REFERENCE MATERIALS

Whenever possible, primary reference materials will obtained from the National Bureau of Standards (NBS) or the U.S. Environmental Protection Agency (EPA). In absence of available reference materials from these organizations, other reliable sources may be sought. Reference materials will be used for instrument calibrations, quality control spikes, and/or performance evaluations. Secondary reference material

may be used for these functions provided that they are traceable to an NBS standard or have been to an NBS standard within the laboratory.

1.6. REAGENTS

Laboratory reagents will be of a quality to minimize or eliminate background concentrations of the analyte to be measured. Reagents must also not contain other contaminants that will interfere with the analyte of concern.

1.7. CORRECTIVE ACTIONS

When an analytical system is deemed to be questionable or out-of-control at any level of review, corrective action will be taken. If possible, the cause of the out-of-control situation will be determined, and efforts will be made to bring the system back into control. Demonstration of the restoration of a reliable analytical system will normally be accomplished by generating satisfactory calibration and/or quality control sample data. The major consideration in performing corrective action will be to ensure that only reliable data are reported from the laboratory. The Rockwell International CEARP Manager will be informed of the problem and all corrective actions taken.

1.8. DATA MANAGEMENT

1.8.1. Data Collection

All data will be recorded in laboratory notebooks. Laboratory notebooks will contain:

- Date and time of processing
- Sample numbers
- Project
- Analyses or operation performed
- Calibration data
- Quality control samples included
- Concentrations/dilutions required
- Instrument readings
- Special observations
- Analyst's signature.

Copies of laboratory notebooks will be provided to the Rockwell International CEARP Manager on request.

1.8.2. Data Reduction

Data reduction will be performed by the individual analysts. The complexity of the data reduction will be dependent on the specific analytical method and the number of discrete operations (extractions, dilutions, and concentrations) involved.

For those methods utilizing a calibration curve, sample responses will be applied to the linear regression line to obtain an initial raw result which will be factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained, to minimize rounding errors, and results will not normally be expressed in more than two (2) significant figures.

Copies of all raw data and the calculations used to generate the final results will be retained in the laboratory file to allow reconstruction of the data reduction process at a later date. Copies of these records will be provided to the Rockwell International CEARP Manager on request.

1.8.3. Data Review

System reviews will be performed at all levels. The individual analyst will review the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews will be performed prior to submission of data to the laboratory management.

Laboratory management will review data for consistency and validity to determine if program requirements have been satisfied. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analysis should be repeated. In addition, laboratory management, will recalculate selected results to verify the calculation procedure. Any abnormalities will be brought to the attention of the Rockwell International CEARP Manager.

The Quality Assurance Officer will independently conduct a complete review of results from randomly selected samples to determine if laboratory and program quality assurance/quality control requirements have been met. Deviations from requirements will be reported to the laboratory management and Rockwell International CEARP Manager for resolution.

Non-routine audits may be performed.

1.8.4. Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, and method blanks data. In addition, special analytical problems, and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) significant figures.

Data will be reported in units commonly used for the analyses performed. Concentrations in liquids will be expressed in terms of weight per unit volume (e.g., milligrams per liter). Concentrations in solid or semi-solid matrices will be expressed in terms of weight per unit weight of sample (e.g., micrograms per grams).

Reported detection limits will be those specified by the analytical method.

1.8.5. Data Archiving

The laboratory will maintain on file all of the raw data (including calibration data), laboratory notebooks, and other pertinent documentation. This file will be maintained at the laboratory for a period of time consistent with Rocky Flats Plant's requirements. At the end of that time frame, all these records will be given to Rocky Flats Plant.

2. PERFORMANCE AND SYSTEM AUDITS

Quality assurance audits will be conducted. System audits will be conducted at random, unscheduled intervals at least annually.

Audits will be planned, organized, and clearly defined before they are initiated. Auditors will identify nonconformances or deficiencies. These will be reported and documented so that corrective actions can be initiated through appropriate channels. Corrective actions will be followed up with a compliance review. A report on each audit will be sent to the Rockwell International CEARP Manager.

2.1. FIELD AUDITS

Unannounced field audits, investigating conformance with QA/QC procedures, will be performed. A typical checklist for this type of audit is shown in Table A-1. A written report on the results of this audit will be submitted to the Rockwell International CEARP Manager.

2.2. CORRECTIVE ACTION

After each audit, auditors will identify nonconformances in a written nonconformance notice and initiate corrective action through the Rockwell International CEARP Manager. The nonconformance notice will describe any nonconforming conditions and set a date for response and corrective action(s). The Subcontractor Project Manager will prepare a written proposal for corrective action for review and approval by the Rockwell International CEARP Manager. When approved, the proposed corrective action(s) will be implemented. Follow-up review will be performed by the auditor to confirm that the corrective actions have been implemented.

Table A.1. Field Audit

Project_____ Site Manager_____

Site Location_____ Field Team Leader_____

Auditor_____ Date_____

Audit Question	Yes	No	Comment/Documentation
1. Was a site-specific sampling and analytical plan followed?			
2. Was a field team leader appointed?			
3. Was the site health and safety coordinator present?			
4. Were field team members familiar with the sampling plan?			
5. Was a briefing held offsite, before any site work was begun, to acquaint personnel with sampling equipment and assign field responsibilities?			
6. Was the daily briefing and safety check conducted?			
7. Was a completed "Site Personnel Protection and Safety Evaluation Form" read and signed by all visitors and personnel entering the site?			
8. Was a field notebook assigned to the field team leader?			
9. Were entries made in the field notebook?			
10. Were sampling stations located correctly?			
11. Did the number and location of samples collected follow the site-specific sampling plan?			

Table A.1. (Continued)

Project_____ Site Manager_____

Site Location_____ Field Team Leader_____

Auditor_____ Date_____

Audit Question	Yes	No	Comment/Documentation
12. Were samples identified as described in the site-specific sampling plan?			
13. Were samples collected following procedures specified in the site-specific plan?			
14. Was a chain-of-custody form filled out for all samples collected? Were all sample transfers documented?			
15. Were samples preserved as specified in the site-specific sampling plan?			
16. Were the number, frequency, and type of samples (including blanks and duplicates) collected as described in the site-specific sampling plan?			
17. Were the number, frequency, and type of measurements and observations taken as specified in the site-specific sampling plan?			
18. Were blank and duplicate samples properly identified?			
19. Was a record maintained of calibration of field equipment?			
20. Was field equipment calibrated as required?			

Table A.1. (Continued)

Project_____ Site Manager_____

Site Location_____ Field Team Leader_____

Auditor_____ Date_____

Audit Question	Yes	No	Comment/Documentation
21. Have any procedures been revised?			
22. Are revisions to procedures adequately documented?			
23. Was the document log for chain-of-custody records and other sample traffic control forms maintained?			
24. Have any accountable documents been lost?			
25. Did drilling and well construction follow procedures outlined in the sampling plan?			
26. Were the activities being conducted compatible with the environmental conditions?			

8.0 DOCUMENTATION AND DATA MANAGEMENT

8.1 DOCUMENTATION

All sampling activities and calibrations will be documented in field notebooks and log books, respectively. Such entries will be as descriptive and detailed as possible, so that a particular situation can be reconstructed.

Field notebooks and log books will be bound with consecutively numbered pages. The sampling supervisor will assign a number and title to each notebook.

The following information will be recorded in the field notebooks for each visit to each sampling location:

- location or station number,
- field activity,
- date and time,
- weather,
- personnel present, and
- level of health and safety protection.

All information related to the field activity will be recorded in the field notebook at each sampling location (i.e. water levels, purge volume calculations and results, instruments used, sample numbers, and PID readings). Any other significant observations should also be recorded. All entries will be made in ink. If an incorrect entry is made, the data will be crossed out with a single strike mark and initialed.

A calibration log book will be kept with each field instrument. All calibrations, maintenance, and repairs for that instrument will be recorded in the log book, initialed and dated.

Chain-of-custody forms will be filled out in the field for each sample. They will accompany the sample to the laboratory where they will be relinquished to the laboratory staff.

8.2 DATA MANAGEMENT

Analytical results and field water quality data will be routinely loaded into a computerized database. Original laboratory reports will be stored in the QA/QC files. The database system will be programmed to perform simple checks of the analytical results including cation-anion balance, comparison of total weight of detected species to determined dissolved solids concentration, and comparison of dissolved solids to specific conductance. In addition, the system will compare the new results to previous results for analysis of trends or outliers. The system will also be capable of making report-ready listing of the data, including the appropriate number of significant figures and the reported detection limit for non-detectable values.